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A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY
LEWIS STEPHEN PILCHER, M.D., LL.D.
OF NEW YORK.

WITH THE COLLABORATION OF

J. WILLIAM WHITE, M.D., LL.D. OF PHILADELPHIA, Professor of Surgery in the University of Pennsylvania.	SIR WILLIAM MACEWEN, M.D., LL.D. OF GLASGOW, Professor of Surgery in the University of Glasgow.

SIR W. WATSON CHEYNE, C.B., F.R.S.,
OF LONDON,
Professor of Surgery in King's College.

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CONTRIBUTORS TO VOLUME LV.

Alexander, Emory G., M.D., of Philadelphia, Demonstrator of Fracture Dressings, Jefferson Medical College and Woman's Medical College; Assistant Surgeon, Kensington Hospital for Women, Surgeon to Out-Patient Department, Episcopal Hospital, and Children's Hospital, Mary J. Drexel Home.

Balfour, Donald C., M.B. (Tor.), of Rochester, Minn., Associate Surgeon to St. Mary's Hospital.

Bartlett, Willard, M.D., of St. Louis, Mo.

Beckman, E. H., M.D., of Rochester, Minn., Assistant Surgeon to St. Mary's Hospital.

Bernheim, Bertram M., M.D., of Baltimore, Md., Assistant in Surgery the Johns Hopkins University.

Bloodgood, Joseph C., M.D., of Baltimore, Md., Associate in Surgery in the Johns Hopkins University.

Boothby, Walter M., M.D., of Boston, Mass.

Brickley, W. J., M.D., of Boston, Mass., Resident Surgeon in the Haymarket Square Relief Station.

Brown, Alfred J., M.D., of New York, Demonstrator of Anatomy, College of Physicians and Surgeons, Columbia University; Clinical Assistant, Department of Surgery, Vanderbilt Clinic.

Cobb, Farrar, M.D., of Boston, Mass., Assistant Visiting Surgeon to the Massachusetts General Hospital.

Collins, Howard D., M.D., of New York, Surgeon to the City and J. Hood Wright Memorial Hospitals.

Cotton, F. J., M.D., of Boston, Mass., First Assistant Surgeon in the Boston City Hospital.

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Da Costa, John Chalmers, M.D., of Philadelphia, Gross Professor of Surgery in Jefferson Medical College.

DAVIES, H. MORRISTON, M.C. (Cantab.), F.R.C.S., of London, Associate Surgeon, University College Hospital.

DOUGLAS, JOHN, M.D., of New York, Visiting Surgeon, Bellevue Hospital; Assistant Surgeon, St. Luke's Hospital.

DRUMMOND, HAMILTON, M.B., of Newcastle-on-Tyne, Surgical Registrar, Royal Victoria Infirmary of Newcastle.

EHRENFRIED, ALBERT, M.D., of Boston, Mass.

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ELSBERG, CHARLES A., M.D., of New York.

FINNEY, JOHN M. T., M.D., of Baltimore, Md., Associate Professor of Surgery in Johns Hopkins University.

GIBBON, JOHN H., M.D., of Philadelphia, Professor of Surgery in Jefferson Medical College; Surgeon to the Pennsylvania Hospital.

GIBSON, CHARLES LANGDON, M.D., of New York, Surgeon to St. Luke's Hospital.

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HIBBS, RUSSELL A., M.D., of New York.

HITZROT, JAMES MORLEY, M.D., of New York, Associate Surgeon, New York Hospital; Assistant Surgeon, Bellevue Hospital.

HOMANS, JOHN, M.D., of Boston, Mass., Assistant in Surgery, Harvard Medical School; Surgeon to Out-Patients, Massachusetts General Hospital.

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Lyle, Henry H. M., M.D., of New York, Instructor in Operative Surgery in the College of Physicians and Surgeons of Columbia University; Associate Surgeon, St. Luke's Hospital.

MacCarthy, William Carpenter, M.D., of Rochester, Minn.

McGrath, Bernard F., M.D., of Rochester, Minn.

McWilliams, Clarence A., M.D., of New York, Assistant Surgeon to the Presbyterian Hospital.

Mark, Ernest G., M.D., of Kansas City, Mo., Attending Genito-urinary Surgeon to Kansas City General Hospital.

Martin, Frank, M.D., of Baltimore, Md., Clinical Professor of Surgery in the University of Maryland.

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Mayo, William J., M.D., of Rochester, Minn.

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Müller, George P., M.D., of Philadelphia, Associate in Surgery to the University of Pennsylvania; Surgeon to St. Agnes' Hospital.

Mummery, P. Lockhart, B.C., (Cantab.), F.R.C.S. (Eng.), of London, Senior Assistant Surgeon, St. Mark's Hospital for Diseases of the Rectum; Surgeon, Queen's Hospital for Children.

Nassau, Charles F., M.D., of Philadelphia.

Pancoast, Henry K., M.D., of Philadelphia.

Pilcher, Lewis Stephen, M.D., of Brooklyn, N. Y.

Pool, Eugene H., M.D., of New York, Assistant Surgeon, French Hospital; Associate Attending Surgeon, New York Hospital.

Richardson, Maurice H., M.D., of Boston, Mass., Surgeon-in-Chief, Massachusetts General Hospital; Moseley Professor of Surgery, Harvard University.

Robinson, Samuel, M.D., of Boston, Mass., Surgeon to Out-Patients, Massachusetts General Hospital; Visiting Surgeon at the Harvard Clinic.

Ross, George G., M.D., of Philadelphia, Surgeon to the Germantown and Stetson Hospitals; Assistant Surgeon to the German and University of Pennsylvania Hospitals.

Skillern, Penn G., Jr., M.D., of Philadelphia.

Speese, John, M.D., of Philadelphia, Instructor in Surgery in the University of Pennsylvania.

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Warthin, Aldred Scott, M.D., of Ann Arbor, Mich., Professor of Pathology in the University of Michigan.

Wilson, George H., M.D., of Ann Arbor, Mich., Formerly Staff Assistant in Pathology, in the University of Michigan.

Wilson, Louis Blanchard, M.D., of Rochester, Minn., Director of Laboratories, St. Mary's Hospital.

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ORIGINAL MEMOIRS.

SURGICAL ASPECTS OF MEMBRANOUS PERICOLITIS.

BY LEWIS STEPHEN PILCHER, M.D.,
OF BROOKLYN, N. Y.

AMONG the surgical problems at present under discussion, much interest attaches to the effect upon intestinal peristalsis of certain membrane-like films, which in certain cases are found during exploration of the abdomen covering to a greater or less extent the cæcum and ascending colon. Over most of the areas in which such formations exist they appear as a thin veil-like film, but in some cases at certain limited areas a much more positive fibrous proliferation may be found to be present, producing distinct band-like conditions; these may very materially restrict the expansibility of the intestinal wall, or even bind down the gut at some point so closely as to positively narrow its lumen. The presence of such a membranous new formation at the caput cæci may so bind down the appendix as to markedly angulate it and lead to subsequent degenerative changes in its walls, or may so pull down and fix the terminal portion of the ileum as to interfere with the normal delivery of the fecal content of the ileum into the cæcum (Figs. 1, 5, 9, and 10).

For the first clear description of the pathological considerations and clinical relations of this condition, credit must be given to Dr. Jabez N. Jackson, in a paper read by him so recently as December, 1908 (*Surgery, Gynæcology and Obstetrics,* September, 1909, p. 278). Jackson in his paper very justly remarks that he was sure that this condition had been observed, possibly frequently, by every surgeon of experience. Nevertheless it had not been either properly described from the pathological side or recognized as a clinical entity, neither had it received any special surgical consideration.

Lane, in his paper on chronic constipation, which was published in the same journal in February, 1908, practically describes the condition under consideration, characterizing it as consisting of the development of adhesions between the outer aspect of the large bowel and the peritoneum covering the abdominal wall in its vicinity. This formation, he says, is most apparent at the first instance in the cæcal portion, and gradually extends to the termination of the large intestine. The development of these films and bands of adhesion is considered by him as the sequel of long existing enteroptosis by which has been awakened some increased hypertrophic tendency in the strained fibres of the proper membranous anchors of the bowel, with results that, while they are compensatory as far as the ability to support strain is concerned, they are in some cases pathological in the degree to which they interfere with the normal peristalsis of the bowel.

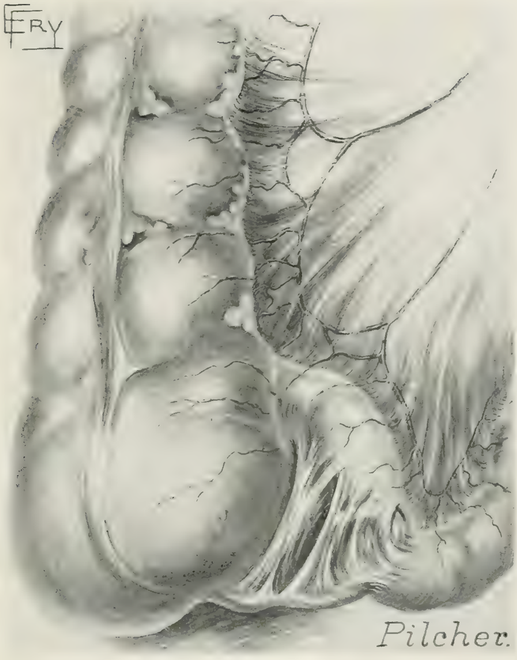
Charles Mayo, in a recent paper (Collected Papers, vol. ii, p. 221), suggests that these bands and films may be due in some cases to the "late rotation of the bowel and descent of the cæcum from its hepatic position after the formation of the parietal portion of the peritoneal cavity in the infant."

He adds, however, that he has observed many cases in which a definite kink of the ileum, within a few inches of its termination, was evidently a condition of inflammatory origin.

Gerster (ANNALS OF SURGERY, September, 1911, 325) regards them as the result of infectious processes associated with chronic colitis.

Since my attention has been called to this condition by these writings and the observations of my sons, Drs. Paul and James Pilcher, I have looked for it, and having learned to recognize it, I have found it to be by no means a

Fig. 1.



The simpler and more common disposition of adhesion bands binding appendix, cæcum and ileum together.

rare condition. I am sure that I had seen it repeatedly in past years, but my eyes had been closed so that I had not appreciated its meaning nor its relations to the symptoms for the relief of which my efforts were being exerted.

As to the *etiology* of these films and bands, that view which considers them to be *the result of long-continued or oft-repeated mild infections of the peritoneal covering of the cæcum and appendix* transmitted through the intestinal wall seems to me most probable. No one who has operated many times for the removal of the appendix can have failed to note the frequent co-existence of a more or less extensive, and a more or less intense, congestion of the cæcal peritoneum, a true typhlitis.

Thus, for example, in a woman under our care during the past year, who had suffered for six weeks from the symptoms of a subacute appendicitis, when she was operated upon an elongated, thickened, and congested appendix was indeed exposed and removed, but more, and of especial interest in this connection, the peritoneal surface of the adjacent cæcum also was much congested and was covered with a thick membranous film.

I have long appreciated that in occasional instances this co-existing perityphlitis and pericolitis was a more important pathological entity than the appendicitis itself.

In the cases which form the chief basis of the present communication, the history clearly indicated in each case that a pre-existing local infection was the cause of the films, which operation demonstrated to be present as a part of the morbid changes which had taken place.

The *symptoms* which such pericolitic membraniform new formations may produce will depend upon the degree of interference which they occasion with the proper function and circulation in the part. Though they may vary much in detail they will still have a general similarity. Discomfort, increasing at times to positive pain, in the right iliac region is quite constantly present. Deep pressure in this region will elicit tenderness. Exacerbations of this tenderness due to matters of diet or exercise occur from time to time, accompanied by colicky cramps, significant of paroxysms of muscular spasm in the bowel musculature.

Fecal stasis to a varying degree is the result of various factors which combine in many different degrees, at various times and in different cases, to interfere with the onward progress of the intestinal content. These are:

(*a*) Defective peristalsis due to the manner in which the bowel is hampered and confined by a broad enveloping film, or tied down by stronger and more distinct bands and adhesions; (*b*) Real obstruction due to a diminution of the bowel's lumen by constricting bands or sharp angulations; (*c*) Enterospasm, a variable, uncertain, and possibly transient but recurrent factor. The constant fretting of the affected segment of the gut in its efforts to do its work and the irritable condition of the wall of the gut predispose to the production of muscular spasm. Such spasm increases for the time obstruction and aggravates the local pain and tenderness. (*d*) Autointoxication: A long train of multiform general symptoms springs from the defective fecal drainage, more or less marked according to the avidity of the absorbents of the imperfectly drained segment and the special resisting power of the individual. The condition is quite different from that of ordinary constipation, in which the more or less dehydrated fecal matter is retained in the descending colon and sigmoid flexure, where the provisions for bacterial changes and for absorption are at a minimum. Into the cæcum and the adjacent ascending colon pour the fluid contents of the ileum; intestinal bacterial activity is here at its highest point, the supply of organic material in the most favorable condition for putrescent changes is continuous, the absorbents are abundant and active; drainage from this portion of the intestine should therefore be always adequate and prompt, and whenever it is interfered with, the symptoms of autointoxication become at once a prominent element in the symptom complex that attends the condition.

The systemic symptoms produced by the autointoxication caused by defective cæcal drainage may in fact so dominate the situation that the less strongly accentuated local symptoms may be quite overlooked, or accepted as of little importance. The essential element, however, is the fecal stasis in the cæcal region. The vicious train begins with chronic pericolitis, includes next constricting bands and restraining films, then fecal stasis develops, then autointoxication ensues, and finally neurasthenia in some of its many forms crowns the process.

Pain may be felt in and often is referred to the stomach, and the secondary gastric distress and digestive disturbance may be so marked as to be considered as primary both in time and importance. The teaching, that in all cases of chronic gastric disturbance the condition of the cæcum and its appendix should be carefully inquired into, is eminently sound, for in a considerable proportion of such cases in the latter region is to be found the root of the disorder.

Kidney Complications.—Renal irritation and ultimate chronic nephritis may be a sequel to the long-standing cæcal stasis and should not be overlooked. It has been demonstrated by Franke (*Coliinfektion der Harnwege, Mitteilungen aus den Grenzgebieten der Med. und Chir.*, No. 4, pp. 511–674) that the cæcum and ascending colon are connected by a train of lymphatics with the right kidney. He further states that bacteria are able to pass directly from the intestine into the lymph-vessels if there is even a slight lesion of the intestinal wall. That there are produced by these micro-organisms inflammatory lesions of the wall severe enough to cause the production of a thickened tissue externally (membranous pericolitis) is evidence that such transmigration of the bacilli through the wall and into the surrounding lymph spaces does take place not infrequently. That some pathologic conditions of the kidney are directly consequent to precedent pathologic changes in the cæcum and ascending colon seems to be exemplified in such cases as the following in our series:

Case I.—The patient was a lady who had for some time suffered from obstinate constipation. Two months before examination, after some unusual exertion, she began to suffer from severe cramps across the lower abdomen. The pain, after several days' duration, finally limited itself to the right side of the abdomen in its lower quadrant. Several days subsequently, sharp stabbing pains referred to the right costovertebral angle began to be complained of, and at this point there was marked tenderness. During the succeeding weeks she suffered from a frequency of urination, and at times the tenesmus of the bladder was practically continuous. The urine contained a slight amount of pus, a trace of albumin, and numerous granular casts.

Cystoscopic examination showed an open dilated ureter ostium on the right side, the left being normal. The phenolsulphonephthalein reaction showed a delay of function in the right kidney of 29 minutes, the left being normal 10 minutes.

Operation, three months after the onset of the patient's complaint, revealed a chronic appendicitis and pericolic adhesions, with right kidney markedly congested and surrounded by a zone of perinephritic infection of recent development and in an acute stage.

Case II.—A woman, twenty-four years of age. Had been suffering for several years from progressive constipation without any noticeable constitutional effects. Twelve weeks before examination by us she was seized with an acute pain referred to the right side. Its duration was brief and was accompanied by the passage of blood in the urine. It recurred at intervals subsequently, and radiated down the course of the right ureter to the labium. At various times she continued to pass small amounts of blood in the urine. There was a moderate frequency of urination during the day. Pus was reported in the urine by her physician during these attacks. Her chief complaint was continued pain in the back and painful urination. After cystoscopic examination elsewhere she was advised to have the right kidney removed, although repeated X-ray examination failed to show any stone. She now came under our care. Renewed cystoscopic examination showed a right-sided œdema of the trigone, leading directly up to the right ureter opening, which, however, was normal. Catheterization of the right ureter showed in the urine obtained an excess of renal cells, a few red blood-cells, but no pus. Vaginal examination elicited a tender point on the right side corresponding to the position of the ovary, pressure upon which caused the same pain which the patient had previously complained of. Abdominal palpation elicited a moderate tenderness over the region of the appendix and cæcum.

The previous advice of direct approach to the kidney was disregarded and a median suprapubic incision undertaken. The right ovary was found markedly diseased and the right tube much congested and thickened. The appendix was the seat of a chronic inflammation of subacute type and was removed. The cæcum and ascending colon were further found to be covered by a definite film of inflammatory new formation, which was dissected off. Convalescence was uneventful, and after the second day up to the present time no further subjective sensations referable to the kidney have been remarked by the patient, and the urinary secretion became quickly normal.

To these particular cases which have come to operative demonstration, I would add the observation of our associate in radiography, Dr. Charles Eastmond, who informs us that he has noticed in many patients sent to him for kidney pictures, cases in which renal pain had caused suspicion of the presence of stone in the kidney, that in those cases in which the X-ray reveals no evidences of stone present in the kidney it was noticeable that in many the cæcum and ascending colon were markedly dilated and that also in many instances the kidney was lower than normal.

The anatomical fact that the lymphatic connections of the cæcum and ascending colon with the right kidney are such as to make possible the infection of the kidney from the cæcum and colon under certain conditions, this fact, I say, is of sufficient importance to lend additional gravity to the existence of the colonic condition. Too much stress cannot be placed upon the fact that in an individual case the right portion of the large gut and the right kidney may both be diseased, and that unless careful examination be made the pathologic condition involving the alimentary canal is likely to be overlooked, although it is the primary causative factor. In such a case an attack upon the kidney alone, from which the major complaint arises, would still leave conditions that would make the result imperfect. Persistent pain, referred subjectively to the right kidney, with some pus and blood and casts in the urine, with negative X-ray findings as to stone in the kidney and positive evidence of cæcal stasis, should suggest active efforts to relieve the latter as the condition of fundamental importance.

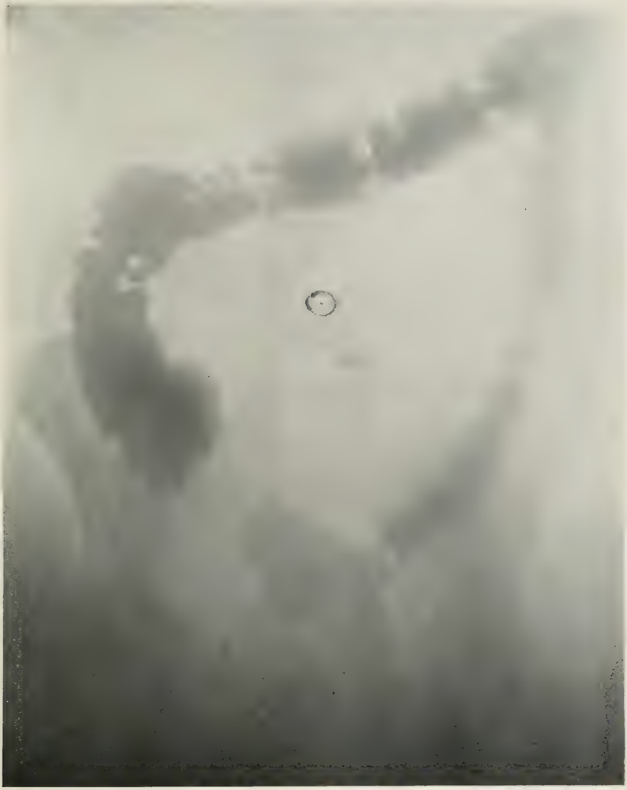
Diagnostic Use of the X-ray.—In case of chronic pain in the right iliac region, associated with intestinal disturbances, skiagraphs of the cæcum and colon, filled with a bismuth emulsion, are of great assistance in arriving at a positive diagnosis. The clear manner in which the colon can thus be outlined and its course traced is extremely striking. By aid of the bismuth filling the location and degree of a constriction, the presence of an angulation and the amount of ptosis, if any, can be plainly declared.

We present herewith reproductions of a number of skiagraphs so obtained, the special features of which are detailed in the legends attached to the several plates (Figs. 2, 3, 4, and 8). The skiagraphic work in these cases has been done by Dr. Charles Eastmond.

The technic of this bismuth meal is as follows: The bowels having been emptied during the day by a dose of castor oil, the patient is given at ten o'clock in the evening a mixture containing from two to four ounces of bismuth subcarbonate, the amount to be determined by the size and weight of the patient. To this is added six ounces of mucilage of acacia, and the quantity thus obtained made up to sixteen ounces with top milk, which serves to disguise the insipid taste of the bismuth and the acid taste of the acacia. The patient then reports to the radiographer the following morning at nine o'clock, after an approximate interval of twelve hours, at the end of which time it will usually be found that most of the bismuth emulsion has passed the terminal ileum and has already filled the first part of the big gut. Subsequent exposures must be determined according to the degree to which the bismuth is found to have progressed along the bowel at the first examination. In many cases a supplementary enema of bismuth is administered through a short rectal tube. Observation shows that the emulsion is carried around to the cæcum within four or five minutes by retrograde peristalsis. By combining the two methods a good demonstration of the entire large intestine can be secured (see Fig. 2).

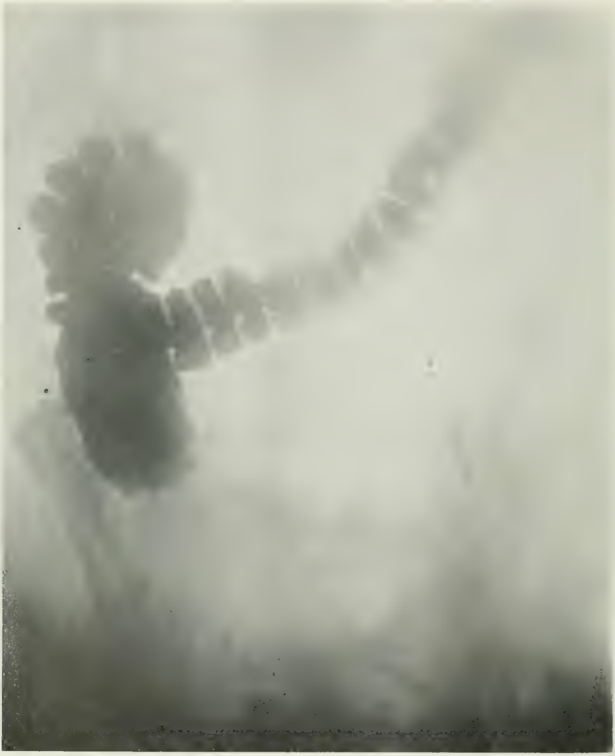
Position of the Cæcum and Colon.—Necessarily some familiarity with the location and appearance of the normal

FIG. 2.



The normal colon. Skiagraph taken 12 hours after the ingestion of bismuth emulsion, supplemented by an enema of the same given 10 minutes before the photograph was made. Note the position of the cæcum in the concavity of the iliac fossa; note the oblique manner in which the transverse colon crosses the abdomen about the level of the umbilicus upward to the splenocostal region on the left; note the sharp angle at the splenic flexure which is typical; note the crumpled folds of the sigmoid flexure in the superior pelvic strait. The position of the umbilicus is indicated by the circle. Skiagraph presented as a standard for comparison.

FIG. 5.



Reduplication of colon by film binding ascending colon and first portion of the transverse together. Position of cæcum somewhat higher than normal; sharp ascent of transverse colon as it passes to the splenocostal region.

N.B. In this case the dominant symptoms were those of obstruction at the splenic angle. At this point, on opening the abdomen was found a constricting band encircling the colon which had been formed by an epiploic appendage whose tip had been thrown around the bowel and adhered to the mesocolon so as to form a circular loop around it. The peritoneal surface of the transverse colon proximal to the point of constriction was congested and presented an incipient membranous film, presumably the early stages of the formation which in a more advanced development had bound the two segments of the colon together in the right iliac region.

intestine, when filled with bismuth mixture, is requisite in order to satisfactorily interpret the X-ray picture. The course and relations of a normal colon are well shown in Fig. 2. The cæcum is seen to be situated well above the brim of the pelvis. When the colon is ptosed, the cæcum may lie near the brim, and in severe cases may hang over into the true pelvic cavity. The hepatic flexure is found at or above the level of the umbilicus. The most constant point of fixation of the colon is at the splenic flexure where the intestine is attached by the short phrenocolic ligament to the left abdominal wall under the spleen. This is the highest attachment of the colon, and to this point the transverse colon normally ascends for some inches and there makes a sharp bend downward, so that portions of the transverse and the descending colon normally lie parallel to each other in close contact for some inches.

Exploratory Incision as a Means of Diagnosis.—While a due consideration of the local and general symptoms which attend cases of membranous pericolitis is sufficient to establish a strong probability of the existence of that condition in a given case, and the findings of the bismuth X-ray picture may corroborate the opinion formed, nevertheless, an exploratory incision is requisite to fully establish the diagnosis, estimate the full extent and nature of the condition, determine its amenability to treatment, and point out the exact procedures needed to best overcome the conditions found.

It should not be forgotten that an unduly mobile cæcum with ptosis may lead to distention, atony, and inflammation of its walls, and thus conduce to fecal stasis and the secondary changes springing therefrom, without the antecedent presence of the membranous films and bands which have been considered in the preceding paragraphs. The symptoms of *cæcum mobile* with atony and stasis and distention with gaseous products differ only in degree from those of the more positive obstruction, and inasmuch as they are amenable to control by such non-operative measures as suitable abdominal supporting bandages, proper exercise and diet, the use of enemata and laxatives, and the administration of intestinal antiseptics, the cautious surgeon would naturally reserve the resort to operative measures until after a reasonable period of trial of such hygienic and medicinal treatment. The persistence of the local symptoms despite treatment should, however, call for operative exploration.

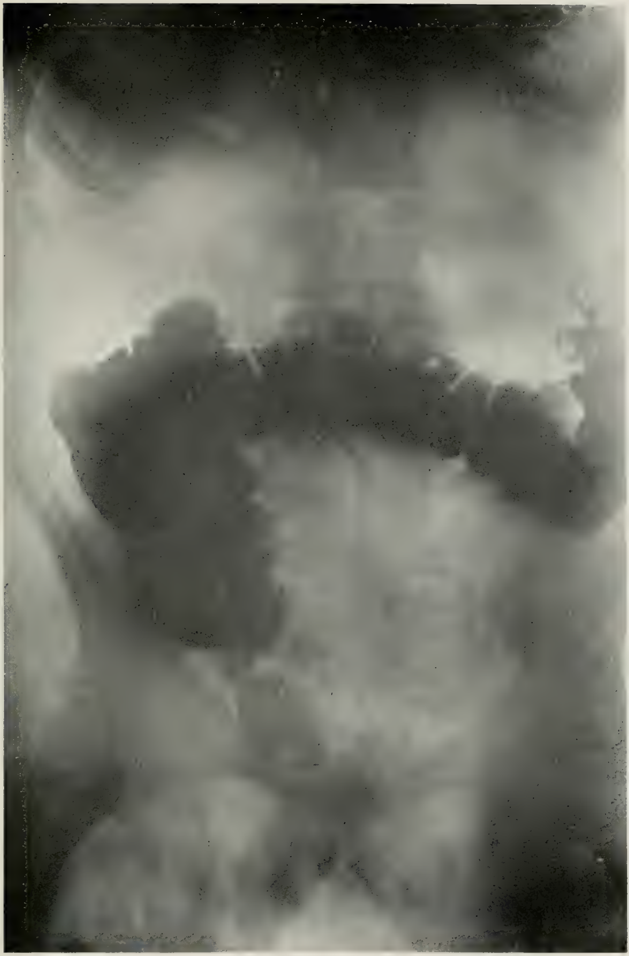
In a large proportion of cases the appendix is involved in the infection process, if indeed it has not been its original nidus, and it is probable that a case will come to operation with the primary diagnosis of appendicitis. It occasionally happens that when the appendix is exposed the changes found in it do not seem commensurate with the symptoms previously existing. In every such case the incision should be made sufficiently free to permit of full exposure and careful examination of the terminal portion of the ileum and the cæcum and colon as far as the hepatic flexure. More than this, it is desirable in many cases that the gall-bladder and pylorus be also palpated and their condition ascertained. In many cases the appendix will already have been removed months or years previous, and the persistent continuance of the right iliac symptoms notwithstanding the removal of the appendix is the occasion of the call for relief.

The best place for such an exploratory incision is along the outer border of the right rectus muscle, or through its substance, opening its posterior sheath. A primary longitudinal incision in this location with its upper end at a point somewhat above the umbilicus and extending downward some three inches or more will give good access to the region involved. Such an incision can readily be prolonged in either direction as the subsequent needs of the exploration may indicate.

The primary indication of treatment after the abdomen has been opened is to cut all the confining bands and remedy any sharp angulation that may be demonstrable (Figs. 1, 5, 8, 9, 10, and 12). A thin pannus-like membranous veil spreading out over the anterior wall of the intestine as a whole need not be removed *in toto,* but any cord or band-like aggregation of its fibres should be cut, possibly repeatedly, until full relaxation is obtained.

All raw surfaces produced by the freeing incisions must be

FIG. 4.



Membranous pericolitis with partial obstruction at hepatic flexure by band. Head of cæcum and terminal portion of ileum bound down to brim of upper pelvic strait. The skiagraph shows the cæcum and ascending colon to be distended by the bismuth mixture; the partial obstruction at the hepatic flexure is demonstrated. Note the cæcum drawn down to and projecting over the brim of the pelvis; note the lowered position of the transverse colon, which crosses the abdomen in a nearly straight direction below the level of the umbilicus, and then makes a marked angle in the left iliac fossa as it turns upward to ascend to the splenocostal region.

covered in by peritoneum secured by sutures, so as to prevent the renewed formation of crippling adhesions.

After-treatment should not be neglected following operative recovery. This should be along the same lines as those employed for relief before operation, and should now be followed by much more positive and lasting benefit.

ILLUSTRATIVE CASES.

CASE III.—An intelligent man, thirty-seven years of age, presented himself with the following history: As a youth and young man he had enjoyed good health and had displayed an activity and energy above the usual. About five years ago he began to suffer from pain and tenderness in the right iliac region. This was diagnosed as appendicitis, and for its relief he was operated upon in the usual manner by a surgeon in a neighboring State. He made a rapid and uncomplicated operative recovery—was out in two weeks—but since that time has never been well. He has suffered constant discomfort in the right iliac region, with frequent attacks of pain attended with a sense of distention and a perceptible temporary tumor in that region. He has been obstinately constipated, has manifested the usual effects of autointoxication, such as headaches, general malaise, exhaustion after slight physical effort, imperfect circulation as manifested by coldness and clamminess of the hands and feet, dizziness whenever he bends down, appetite good but frequent nausea, furred tongue, yellowness of the conjunctivæ, drowsiness, unrefreshing sleep.

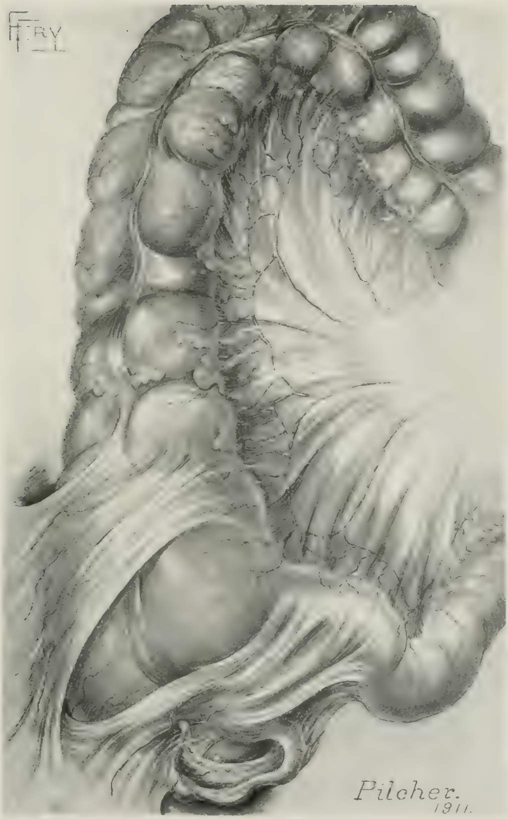
Examination at the time of admission to the hospital confirmed the above conditions, except that palpation of the abdomen was negative save over the gall-bladder, where deep pressure elicited some tenderness. A bismuth X-ray skiagraph gave a distinct outline of the last portion of the ileum, of the cæcum, and the colon (see Fig. 4). There did not appear to be any kink in the ileum, but the base of the cæcum was depressed to the brim of the pelvis. The whole cæcum and ascending colon up to the hepatic flexure were greatly dilated, and the dilated portion was limited by a well-marked line of constriction which separated the hepatic flexure from the first portion of the transverse colon. The remaining portion of the colon, which had been filled by a bismuth enema, was normal. A second exposure, made thirty minutes subsequent to the first, showed the cæcum less distended, some of the bismuth mixture filling it having now passed into the transverse colon.

As the patient had been under appropriate medical treatment for a long time, there was no hesitation in resorting without further delay to exploration. This was carried out by means of a five-inch incision through the upper and middle portion of the right rectus muscle. The head of the cæcum was found bound down to the brim of the pelvis by a fairly dense membranous sheet of inflammatory new formation (Fig. 5), which extended out upon the last three inches of the ileum. The appendix was absent, its point of insertion into the cæcum being marked by a smooth scar. The ascending colon, as far as the hepatic flexure, was covered by a thin translucent pannus-like film of similar character. At the hepatic flexure this was thickened into a well-marked band about one-half inch in width, which constricted the flexure. A free division of the ileocæcal pelvic sheet was made so as to free the head of the cæcum and the ileum to a normal degree (Fig. 6). The great vessels along the brim of the pelvis were exposed in this demonstration. The reflected portions of the peritoneum were replaced and sutured into position so as to cover in the raw surfaces exposed by this procedure (Fig. 7).

The film covering the anterior surface of the colon was carefully divided in the direction of the longitudinal axis of the bowel and allowed to retract, so as to expose the normal longitudinal band running along that portion of the intestine. The result of this division was manifestly to render more mobile the intestine. The band binding down the hepatic flexure was then divided and the hepatic flexure loosened. The peritoneum was drawn over the raw surfaces.

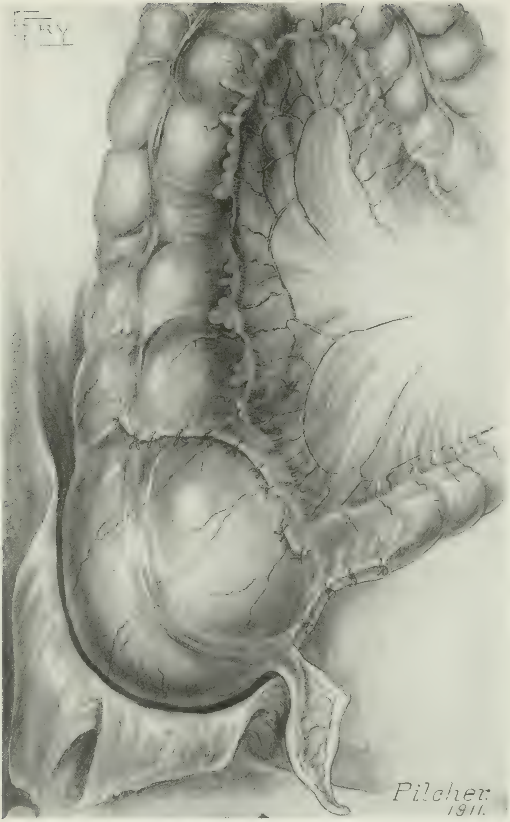
Careful examination of the gall-bladder and gall passages and adjoining viscera was then made, and no appreciable lesions were detected. They were not disturbed. The wound was then closed by the usual layer suture. A smooth operative recovery followed. The later effects of these measures have been relief of the constipation, the cessation of the local pains in the right iliac region upon the disappearance of the constipation, and a marked improvement in the neurasthenia.

FIG. 5.



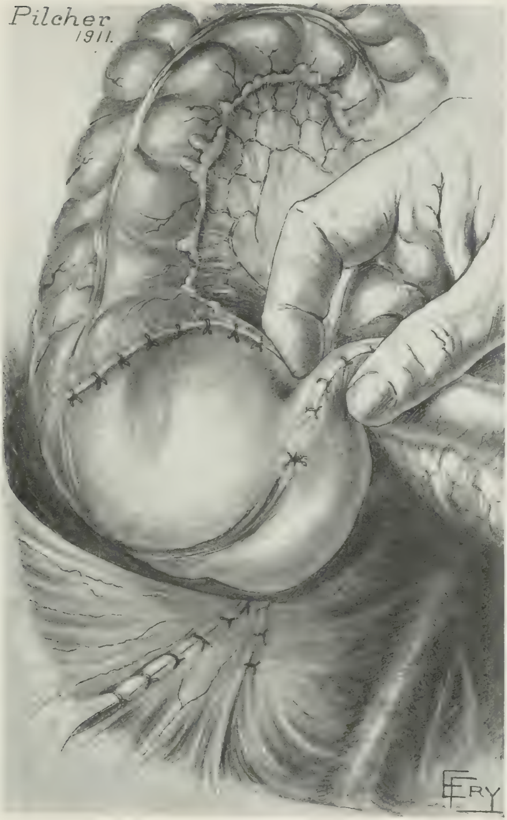
A further extension of pericolic films. In addition to the adhesions binding together the appendix, cæcum, and ileum, note the strong band extending from the ileum to the iliac fossa and the films restricting the mobility of the cæcum and the ascending colon. Case III.

FIG. 6.



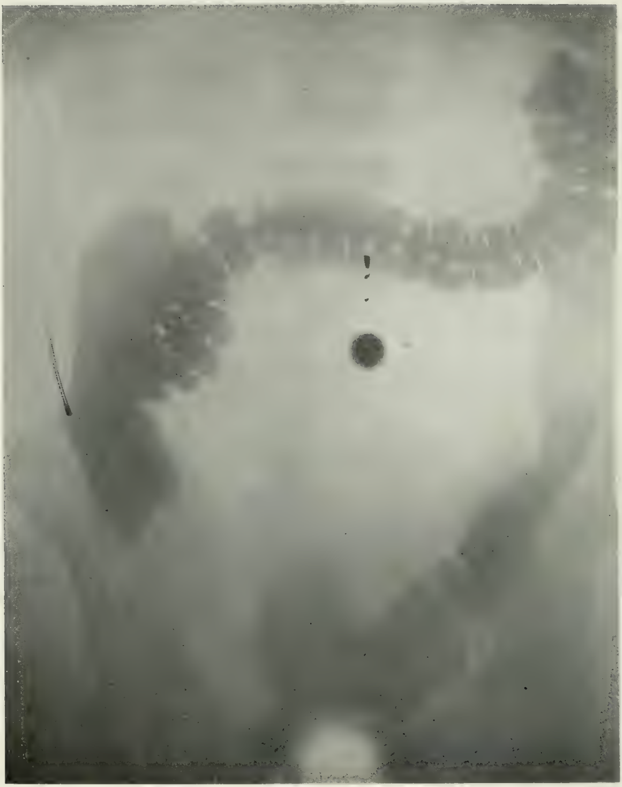
To show operative steps taken for the relief of the condition shown in Fig. 5. Membranous fold binding ileum, appendix and head of cæcum divided transversely and sutured longitudinally; appendix freed and ready to be removed; film and bands over cæcum and colon divided, dissected back, ready to be tucked and sutured beneath the freed cæcum.

FIG. 7.



Condition as presented at the conclusion of the operation for relief in Case III. The ileum and the head of the cæcum have been freed and are now being held up by the thumb and finger of the operator; the appendix has been removed; that portion of the floor of the iliac fossa from which these parts have been enucleated is again carpeted by peritoneum secured by proper lines of suture.

Fig. 8.



Acute angle at hepatic flexure. Ascending and first portion of transverse colon bound together after the fashion of the two barrels of a double-barrelled shot-gun by membranous veil containing multiple well-defined bands shown in the sketch forming Fig. 9. Note there is no ptosis of the cæcum or colon.

CASE IV.—This patient was a large, athletic, finely developed man, thirty-four years of age, who had always pursued an outdoor occupation. Seven years ago he was subjected to operation for what was diagnosed as acute appendicitis, from which operation he made an apparently uncomplicated recovery. At the end of a year, however, he began suffering from pain in the right iliac region of the same character and in the same location as that which had attended his primary attack, though less intense in degree. He was laid up by this for some days. Since that time up to the present he had had frequent similar attacks lasting from a few hours to a day. These he described as being attended with a sense of distention, and at times a visible tumor in the region of the cæcum could be determined. Relief was experienced after the sensation of the passing of gas. The bowels were habitually constipated, and at the time of these attacks relief followed a movement of the bowels. At the present time he has discomfort practically all the time over the region of the ascending colon and has the typical symptoms of autointoxication.

Upon examination there was tenderness upon pressure in the right iliac region. Gurgling sounds were produced by pressure on the cæcum and ascending colon, and percussion over the ascending colon was markedly tympanitic. A bismuth X-ray skiagraph (Fig. 8) showed the cæcum in normal position. The hepatic flexure lay somewhat lower than normal, and the first portion of the transverse colon was sharply angulated, so that some inches of the first portion descended in front of the ascending colon. Then it ascended in a sharp angle to the splenic flexure, which was normally placed. The descending colon and sigmoid were normal.

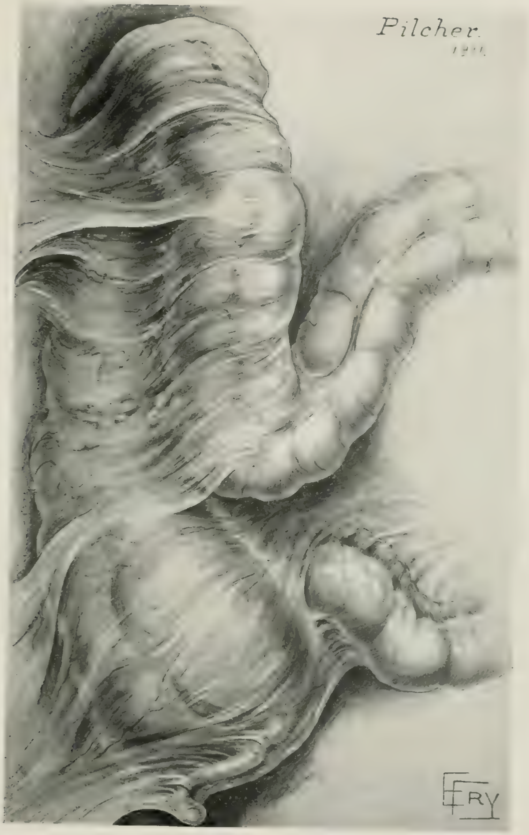
After the usual period of preparation the abdomen was opened by a longitudinal incision through the right rectus muscle. The ascending colon and hepatic flexure when exposed were found to be covered over their whole extent by a thin translucent membranous film, with well-marked, vascular congestion of the whole area. The thickened right border of the omentum at its tip was densely adherent to the wall of the flank near the iliac crest, forming a covering to the underlying colon. This omental mass was divided from its insertion and reflected. After this piece had been reflected there was exposed the first portion of the transverse colon, which was also bound to the same point of the lateral abdominal wall by a very dense, strong, thick fibrous band about one-quarter of an inch in width.

The result had been to sharply angulate the colon at the hepatic flexure and to bring parallel to each other the ascending colon and the first part of the transverse colon, lying side by side like the two barrels of a double-barrelled shot-gun. The two parallel portions of the colon were bound together by thinner, more film-like adhesions (Fig. 9). These were divided and the thick band excised. The stump of this adhesion band on the intestinal side was buried by two points of Lembert suture. The raw area left on the lateral wall of the abdomen was likewise covered in by peritoneum.

Traction upon the cæcum and terminal portion of the ileum showed these structures also to be drawn down and fixed by an extensive film of adhesion. By making traction upon the cæcum it was possible to demonstrate this condition most clearly and note the line of demarcation between the peritoneum of the pelvic wall and the peritoneum of the intestine. This adhesive film was freely divided and the cæcum liberated. The raw surface left was covered in by drawing over it suitable folds of peritoneum. The operation wound was then closed in the usual manner. An uncomplicated operative recovery has followed. Since the operation he has been free from the right iliac discomfort and attacks of pain. His general health has been good. The bowels are somewhat sluggish and he takes a mild aperient twice a week as a matter of precaution or possibly habit.

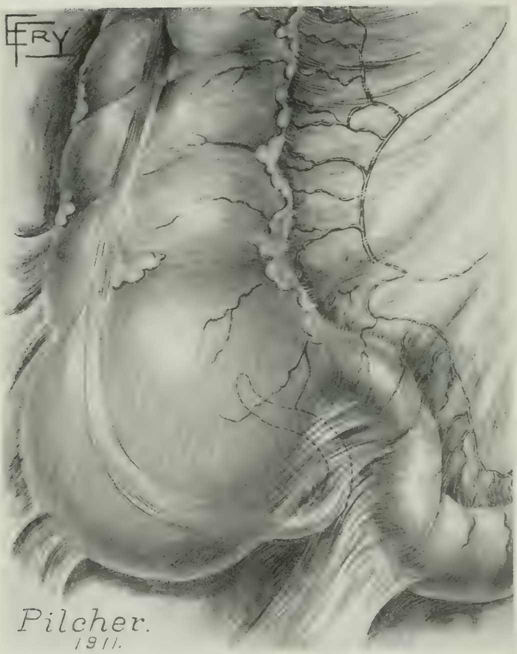
Case V.—This was in the person of a lady thirty-two years of age, who for four years had been suffering from pain in the right iliac fossa. A year after its inception she was subjected to an appendectomy, from which she made a prompt operative recovery, but, nevertheless, continued to suffer from pain and tenderness referred to the right iliac region, with a marked degree of general neurasthenia. With this there was considerable bladder irritability, and there was an enlarged and sensitive right ovary. Urinary and cystoscopic examination negatived any kidney or renal complication. The abdomen was opened and the microcystic condition of the right ovary was remedied by a cuneiform excision. Examination of the right iliac region showed the cæcum bound by a well-marked membraniform film, which extended upward for some inches along the terminal por-

FIG. 9.



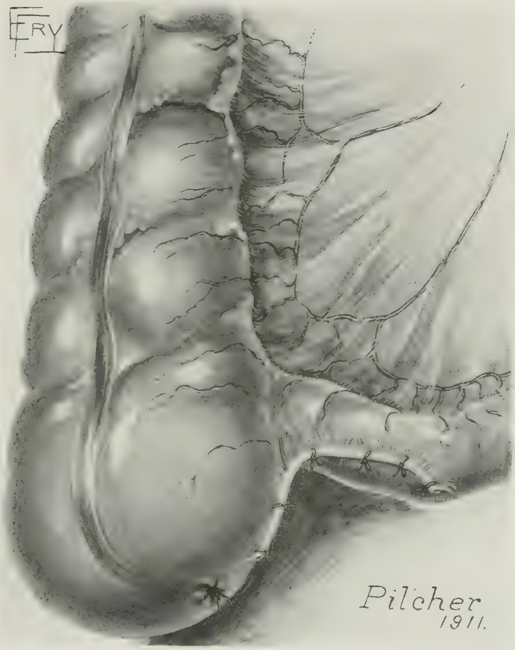
Cæcum and ascending colon covered by membranous film with multiple well-defined bands which extend upon the first portion of the transverse colon and bind it to the ascending colon like the two barrels of a double barrelled shot-gun, with acute angulation at the hepatic flexure. Sketch made from the case, the skiagraph of which is seen in Fig. 8.

FIG. 10.



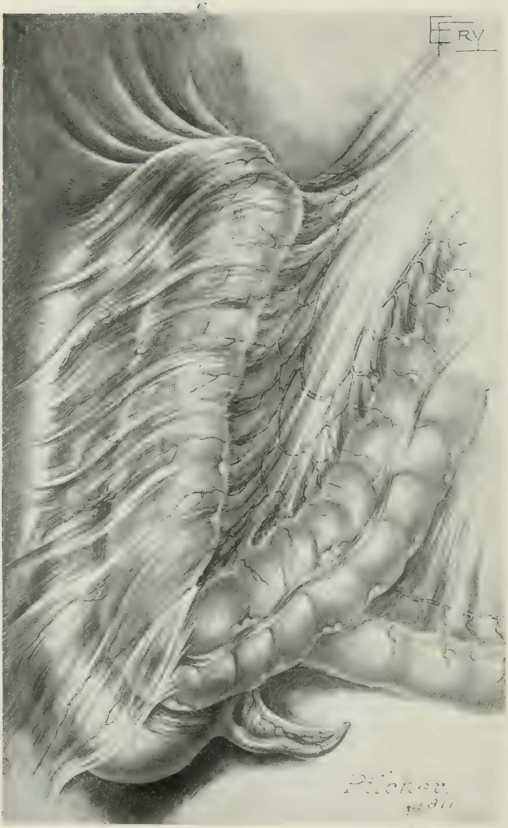
Sketch made to show the condition present in Case V. Terminal portion of the ileum, the appendix and the cæcum bound together by strong membraniform film.

Fig. 11.



Condition left after removal of appendix and restraining bands. Case V.

FIG. 12.



Double barrel shot-gun association of two portions of the colon with acute angulation at the hepatic flexure. Sketch made from Case VI.

tion of the ileum, and bound that portion of the ileum and the head of the cæcum together (see Fig. 10). Along the central portion of the ascending colon there was a marked thickening of the film, which formed distinctly recognizable bands which bound the colon to the lateral peritoneal wall. As the hepatic flexure was approached, this film became much thinner, but still recognizable, containing abundant injected vessels, indicating a condition of continuous irritation. The membrane binding the ileum and cæcum together was divided transversely, and the two portions sutured longitudinally, so as to free the two portions of intestine from each other (see Fig. 11). The pericolic films and bands higher up were likewise divided, and the film dissected back so as to free the colon. The membranous flap produced by this procedure was placed behind the colon and cæcum, where it was attached by suitable points of suture. The parts having been readjusted, the wound was closed. Patient made an uncomplicated operative recovery, with immediate relief from the symptoms of which she had previously complained. The immediate improvement in her general neurasthenic manifestations was very marked.

Case VI.—This patient was a lady fifty-one years of age, who had long been a delicate, ailing, neurasthenic woman. She suffered from retroversion of the uterus, and finally developed a large myoma, which was removed in 1904 by Dr. Paul M. Pilcher. She has for years suffered from pain and tenderness diffused through the lower abdomen, more particularly and constantly felt on the right side. She has had many transient attacks of sharp pain referred to the right hypochondriac region. More recently she has complained also of gastric discomfort. Her bowels have always been regular. The presence of renal and bladder complications was eliminated by proper examination. Upon opening the abdomen, the duodenum, gall bladder, and stomach were found to be normal. The colon was sharply angulated at the hepatic flexure, and the first part of the transverse colon descending sharply as far as to the ileocæcal junction was bound to the ascending colon, cæcum, and ileum by a well-marked membranous film, which presented at points along its course well-marked bands of thickening, these being lost beyond in the substance of the mesocolon (see Fig. 12). This membrane was divided longitudinally throughout its whole extent from the cæcum to the hepatic flexure, and the two portions of the colon freed from each other. The appendix, thickened and partially obliterated, was confined and sharply angulated by a thick, short meso-appendix, which extended to its tip and bound it to the outer and posterior portion of the cæcum. This meso-appendix extended also upward upon the adjacent portion of the ileum, and produced a sharp angle in it as well. The appendix and meso-appendix were removed, and the peritoneal planes brought together by sutures, so as to cover in all raw surfaces and free the cæcum and terminal portion of the ileum from any restraining attachment. The patient made an uncomplicated operative recovery, and was at once freed from the special symptoms from which she had previously complained.

CONCLUSIONS.

As a result of these personal observations, together with the experience reported by other surgeons, it has seemed to the writer that these right-sided pericolic adhesions and membraniform crippling veils and bands form a fairly distinct pathological entity deserving of recognition as a well-defined surgical condition. In all cases they are a source of ill health and suffering. In some cases they are a positive menace to life. In most instances they can be relieved by procedures that are attended with a minimum of operative risk.

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THE SURGICAL TREATMENT OF COLITIS.*

BY CHARLES LANGDON GIBSON, M.D.,
OF NEW YORK,

Surgeon to St. Luke's Hospital.

My interest in the surgical treatment of colitis dates back to 1900, when I devised a line of treatment intended to replace the only means recognized then as efficient, namely, artificial anus. This method of mine is the one most generally used to-day; but its origin and usefulness have been considerably obscured by the introduction of a modification in the technic of my original operation by Weir, substituting for my valvular cæcostomy appendicostomy. I hope to be pardoned if I make this paper the subject of a review of the development of the more modern treatment.

As regards the value of the artificial anus, I had been very sceptical, in the brief years it flourished, whether the cure was not worse than the disease. Moreover, the evidence advanced of its curative value was oftentimes unconvincing, and it was natural that the relief obtained should only be partial unless a complete artificial anus was made, absolutely preventing the fecal current from reaching the colon.

If a *complete* artificial anus were made, its eventual repair required a severe operation with a high mortality.

I set out deliberately to devise a form of operative treatment that should be the antithesis of the artificial anus, allowing of no escape of fecal contents.

I felt that if the principles of ordinary surgical drainage and cleanliness could be applied to the large intestine, we would have gained considerably in facilitating the healing of the ulcerated surfaces. That result I thought could be brought about by devising a means of frequently flushing the large intestine, greatly diluting its irritating contents, and removing them from prolonged contact with the ulcerations. So if we could give the patient an opening in the bowel for access to its contents and yet prevent their egress, the problem would be solved.

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* Read before the International Society of Surgery at Brussels, September, 1911.

The Kader form of gastrostomy had then come to be considerably employed, and all I had to do was to use the same technic in the cæcum, which I did. At the outset I believed that by making a suitable incision (intermuscular) we should have a small and easily controlled wound, confinement to bed for its healing ten days or less, the patient could then receive ambulant treatment or administer it himself by introducing the tube several times a day and flushing out the bowels with various appropriate solutions. During the intervals neither tube nor dressing need be worn, and the closure of the wound would be automatic, as the discontinuance of the passage of the tube for a few days would allow of the valve action to become permanent.

All these theoretical requirements were found in general to be feasible in practice; but owing to the introduction of appendicostomy two years later, the origin of the method was lost sight of. I was a long time in getting an opportunity to perform this operation myself; but two of my kind friends, to whom I described this procedure, were good enough to make a trial of it at my suggestion.

Dr. P. R. Bolton performed it in 1900, reporting the case in the *Medical Record* for March 16, 1901, and in November, 1901, Dr. F. H. Markoe also performed it at my suggestion. My first case was performed later in 1901. The method was described in a paper[1] read by me March 5, 1902, in Boston, but publication was delayed till September.

Dr. Weir, in April, 1902, did my operation at my suggestion. The same day he had a second case, and having had some difficulty with my technic (tube was pulled out after being put in place), decided to use the lumen of the appendix as the channel. He lost no time in getting into print, so that, when my article appeared, appendicostomy had already been claimed as the proper treatment for colitis, and is generally so used. I think, whatever its merits from the technical standpoint, that the modern treatment owes its origin distinctly to me. That is, if I had not shown Dr. Weir how to do a valvular colostomy, he never would have thought of treating colitis except by the formation of an artificial anus.

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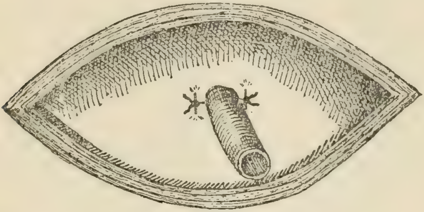
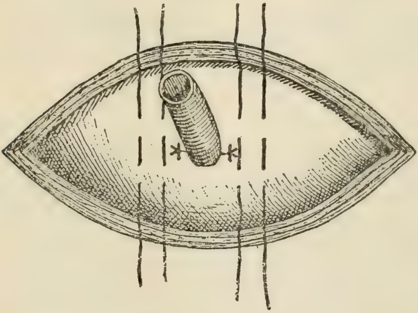
[1] The Creation of an Artificial Valvular Fistula for the Treatment of Chronic Colitis, Boston Medical and Surgical Journal, Sept. 25, 1902.

FIG. 1.



Tube introduced and held in place by the suture placed on either side.

FIG. 2.



The first row of inversion sutures in place but not tied.

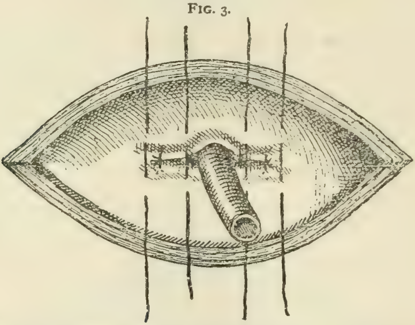
I cheerfully recognize the merits of appendicostomy. It is a little simpler for a person without much surgical skill to perform, and therefore safer. The appendix may, however, not be of a suitable size or position (retrocæcal) to lend itself properly to the procedure, and the patient has to wear constantly a dressing, which is not the case with my technic.

So there still remains some sphere of usefulness to the original operation and I repeat its original description, as given in the *Boston Medical and Surgical Journal*, September 25, 1902.

The technic is as follows:

A small incision—preferably the McBurney intermuscular—is made over the caput coli. If desirable, the anæsthetic can be discontinued so soon as the peritoneum is opened. Nitrous oxide gas anæsthesia might be used. With an intelligent and self-controlled patient local anæsthesia might suffice. Should there be any difficulty in bringing the colon to the surface, I see no positive disadvantage in utilizing the lower ileum. Two Lembert sutures, half an inch apart, are inserted, and the cæcum opened between them. A soft catheter, about 30° F., is introduced so that it projects well into the bowel, and the original sutures tightly tied. The wall of the gut is further infolded around the tube in two superimposed layers. The ends of the superficial layer are used to suture and hold the cæcum to the musculo-aponeurotic structures. The tube may also be secured in place by passing a fine catgut stitch through its wall. The abdominal wound is closed at the angles, or packed. It will be safer not to begin irrigation before three or four days. The tube may be withdrawn in a week or ten days, being introduced only when necessary for the irrigation, and withdrawn so soon as it has served its purpose. If our ideal has been attained, there will be no leakage, even when the colon is visibly distended. Treatment should be persisted in till a cure is obtained. Closure of the fistula occurs spontaneously with the discontinuance of the daily passage of the catheter.

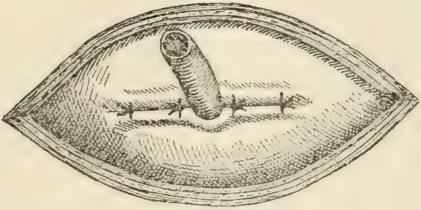
FIG. 3.



The first row of inversion sutures has been tied, the second row in place but not tied.

It seems to me unwise, if not impossible, to attempt at present to formulate any indications for the employment of this measure. From what has been related, it is fair to say that certain forms of colitis can be cured by it. It may be objected that such cases and the ones here described are of the milder variety that would yield to the orthodox treatment. Personally, it seems that the results have been more direct, progressive, and prompt than are attained by the non-operative measures.

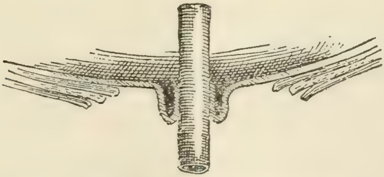
FIG. 4.



Operation completed. The tube is infolded in a furrow of the cæcum.

On the other hand, I do not cherish any illusion regarding certain forms of ulceration, such as the tubercular, that may be properly considered as incurable, especially when accompanied with similar or more extensive changes in the small intestine. Actual experience only can determine whether by frequent cleansing of these ulcerating surfaces and by neutralization of the products of decomposition we can somewhat ameliorate the symptoms, and if to an extent that warrants actual interference.

FIG. 5.



Showing the formation of the valve as seen from within the lumen of the bowel.

With regard to the therapeutic agents that may prove of value when so locally applied, I can only indicate those ordinarily employed. For the present I shall rely principally on the mechanical cleansing by flushing the bowel with an appropriate bland solution, such as the normal saline. It may either be used as a continued irrigation, escaping through a rectal tube, or the colon may be filled to moderate distention, say three quarts, and subsequently evacuated. The frequency should be established by the tolerance of the bowel and the urgency of the symptoms. At the beginning, if well borne, I should prefer to repeat the irrigation at regular intervals of eight or twelve hours, possibly oftener. Agents destined to exert a direct influence on the ulcerating surfaces will naturally act better after the preliminary cleansing. They should be introduced separately from the saline, or after it has been evacuated. The bowel should be flushed with plain water prior to the use of substances such as $AgNO^3$, which combine with the saline.

The required therapeutic agents will also vary somewhat with the nature of the colitis. Gradually increasing strengths of quinine and methylene blue have been recommended for the amœbic form. Nitrate of silver in strengths increased from 1-20,000 will, I think, prove the best single remedial and stimulating agent. The whole gamut of the milder non-poisonous antiseptics, especially of the naphthol group, may be tried, as well as the ordinary astringents. Small doses of iodoform in emulsion might be tentatively tried in the tubercular form. Glutol, a non-irritating derivative of formalin, which acts so admirably in ordinary suppurations, might also be employed. The patient should be on an appropriate, chiefly proteid, diet.

My own experience is very small, but gratifying. Six cases. One tubercular case (unsuitable) was not improved. Four cases were cured. In one subsequently operated upon by another surgeon for another condition, marked healing of many of the ulcerated areas was found. One patient almost moribund was operated upon with local anæsthesia very satisfactorily and was completely restored to health.

None of these cases was of the amœbic variety, which I believe is hard to cure by this or any other means, and are liable to undergo relapse sometimes after long intervals of freedom from symptoms.

SURGICAL TREATMENT OF ACUTE PANCREATITIS.*

BY PROF. DR. W. KÖRTE,

OF BERLIN, GERMANY,

Surgical Director of the Krankenhaus am Urban.

THE surgical treatment of acute inflammations of the pancreas and their sequelæ, pus formation and necrosis, has in the last two decades made marked advances. In 1894 when I made my first communication on this subject before the German Surgical Society it occasioned no discussion. Up to that time acute inflammation of the pancreas had been recognized as a very infrequent affection. However, since then it has become more and more recognized and more frequently diagnosed. This is possibly owing to the fact that the surgical treatment of acute peritonitis has become more and more frequent, and surgeons with increasing experience have become more and more familiar with the handling of peritonitis, and have discovered therefore more frequently the beginning stages of acute pancreatitis, which evidences itself in a serosanguineous exudate, and especially in small areas of fat necrosis.

The light gold spots of necrosis in the abdominal fat are very easy to diagnose from other necrotic processes, and we know certainly that it is occasioned by the outpouring of the secretion from the pancreas, and from this observation the surgeon on opening the abdomen may immediately recognize that the pancreas is the original site of the disease.

My first experiences were with cases which were, however, in the stage of necrosis and peri-pancreatic pus formation. The observation which I made at that time was that the operation should not be attempted in the acute stage because of the very evident inclination to collapse, and that it should be undertaken only in the later stages of necrosis and pus formation. I appreciate now that I was entirely wrong, due to a much greater personal experience and also from the observations of many other surgeons—Hahn, Pels-Leusden, Köhler, Bunger, Garré, and others.

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* Read before the International Society of Surgery, September, 1911.

I wish in the following communication to state my experiences in these cases and to point out that the early operation, here, as in other cases of inflammation of the abdominal organs, is most important to the subsequent recovery of the patient. In 1895 I operated on a case with a diagnosis of acute inflammation of the gall bladder (combined possibly with intestinal obstruction), and found evidences of inflammatory exudate accompanied by spots of fat necrosis. I examined the abdomen for the anticipated occlusion of the intestine, without however being able to find any. I removed a gall-stone from a gall-bladder in which there did not seem to be any evidence of inflammation, sponged the exudate out of the abdomen and drained with iodoform strips. The patient recovered.

At that time the etiologic correlation between pancreatitis and fat necrosis was not so well appreciated as at present, so that I did not correctly interpret the findings in this case.

In 1900 Hahn expounded the great importance of early operation based on the recovery of cases of severe inflammation through the liberation of exudate and drainage with iodoform gauze. Halsted, however, previous to this had a similar case with a successful recovery. He operated in 1899 or 1900 on a patient with the symptoms of inflammatory obstruction, and found on opening the abdomen a serosanguineous exudate and fat necrosis, but no intestinal occlusion. He did find, however, a thick, hardened mass in the region of the pancreas. The abdomen was closed without drainage and the patient made an uncomplicated recovery. On March 3, 1902, in a communication from Dr. Halsted he stated to me that the patient since her recovery from her operation had remained well. In April, 1911, on meeting Dr. Halsted personally, he stated to me that although the patient was still alive, she was very weak and incapacitated. It is a question with me, therefore, in considering this case, whether the recovery might not have occurred without operation and not as a result of operation, although, as the result of our later experience, it seems quite possible that these cases can completely recover merely through the sponging out of the exudate from the abdomen, particularly in cases where there has been no very severe inflammation of the pancreas.

Bunger, in 1901, because of a case of acute hemorrhagic pancreatitis on which he operated and which recovered, also emphasized the necessity for an immediate attack on the organ, and for the first time brought up the question of the importance of direct drainage of the inflamed organ. The experience of Kohler and Pels-Leusden pointed in the same direction. Since this time we have learned to appreciate the absolute necessity of making early incision in all cases of inflammatory peritoneal conditions, and in consequence many operations have been performed in which acute pancreatitis has been discovered as the causative factor, while before this communications regarding such cases were considered rarities, in which but little consideration was given to their outcome.

Before we go into the particulars of the surgical treatment it is important to understand and to define the varieties of acute inflammations of the pancreas. The first attempt at this was made in 1899 by Fitz, in a monograph on acute pancreatitis, in which he described three forms—the purulent, the hemorrhagic, and the gangrenous pancreatitis. His excellent exposition of the subject is even to-day nearly correct, and we have dealt since then more with transition stages and combinations of these three primary forms mentioned by him. Thus can the purulent inflammation run over into necrosis with discharge of portions of the gland. The hemorrhagic inflammation progresses without doubt in many cases into gangrene of greater portions of the gland, and the discharge of pancreatic tissue as a result progresses to peripancreatic pus formations. Thus when one realizes that while it is possible to establish the transition stages in pathological and anatomical examinations, one must also appreciate the fact that it is not possible to sharply differentiate in the patient any of these various stages during life. It is impossible to diagnose inflammation of the pancreas in a great many cases with much positiveness, nor to say further whether the purulent, hemorrhagic or gangrenous form is present, as by early operation we can find nothing but a hemorrhagic inflammation, while in the same case in which operation has been undertaken in a later stage or even from post-mortem examination, the picture of a pancreatic necrosis with very evident retroperitoneal pus formation is to be found. So it seems to me from the clinical point of view most important to speak only of acute pancreatitis.

The acute inflammation declares itself by bloody and serous infiltration of the tissue, evidenced by the swollen organ. The lighter grades of inflammation of the pancreas can unquestionably entirely disappear or go on to the chronic form. Very frequently we find in the cases of patients suffering with acute pancreatitis that earlier they had suffered from less severe disturbances of the same nature, from which they recovered. Unquestionably in this class belong those cases which have recovered after merely evacuating the peritoneal exudate without complete exposition or incision of the pancreas.

In the severer cases of inflammation we find first the profuse hemorrhagic infiltration of the tissues. The corrosive properties of the secretions of the gland tend to eat away the vessels from which severe hemorrhages have occurred into the tissue. This acute hemorrhagic inflammation which has been frequently found in many cases at operation is certainly a definite entity. It frequently causes the death of greater or smaller masses of the gland tissue, and has also in several instances gone directly over into a total necrosis of the pancreas.

Next in order to this hemorrhagic inflammation which results from hemorrhage following an inflammatory process, we have to consider the acute outpouring of blood in the pancreas, which is not the result of inflammation, but of disease of the blood vessels or from trauma of them. These primary hemorrhages go on, in many cases to sudden death. In others, however, the disturbance and infiltration of the gland tissue cause necrosis secondarily. Rarely does the *dead* tissue remain aseptic. There are, however, such occasional cases recorded, in which there has formed in the omental bursa a pseudo cyst in which the contents have been found to consist of large pieces of dead gland. They are, however, exceptions. As a rule these cases pass over into necrosis of the pancreas with pus formation. It is probable, however, that the inflammation occurred primarily after the disturbance of the gland by the hemorrhage and that the bacteria secondarily invaded the sequestrated tissue. It is also possible for acute pancreatitis and also the primary acute hemorrhage in the pancreas, which is not inflammatory, to pass over into necrosis of the pancreas and pus formation, and it is difficult for one to say when they have seen a case first in this stage whether the necrosis is the result of the inflammatory or non-inflammatory hemorrhage. The pus drains over into the omental bursa or develops a retro-peritoneal focus and presents in the flank, more frequently on the left side rather than the right; more seldom the pus ruptures through the gastrohepatic ligament and forms a left sided subphrenic abscess. That form of inflammation or necrotic disturbance of the gland tissue which invades the intralobular tissues, releases pancreatic enzymes, which is evidenced by the small spots of fat necrosis, by which this form of inflammation can rarely be overlooked. Since the experiments of Doberauer, Gulecke and von Bergmann, we must recognize that in the cases of pancreatitis in which there is a free outpouring of the ferment, we can ascribe to it the cause of the severity of the sickness or even the death of the patient.

Next to consider is the purulent form of pancreatitis which finds its etiological factor in the infection carried from the intestines or from the bile passages through the papilla of Vater, or the inflammation can be caused by infection conveyed through the lymphatics (Bartel). Again, pancreatic stones are frequently the cause of pancreatic abscesses. Many smaller abscesses may be so caused or through their combination a large abscess cavity may be formed in the gland. Thus through the decaying of pieces of tissue, hemorrhages can occur from the erosion of the vessels. One draws the conclusion from the foregoing that the various forms of inflammation are not to be sharply defined but rather run over into one another and are combined with each other. Therefore it seems best to me to only consider the condition of acute pancreatitis, in which term I include all three kinds of inflammation and their sequelæ, for the basis of clinical consideration and especially for the indications for treatment.

If we take into consideration the casualty statistics of Villar (French Surgical Congress, 1905) we can appreciate without looking further how difficult it is to fit into the scheme the scattered cases which occur in the literature (acute pancreatitis, hemorrhagic pancreatitis, suppurative pancreatitis and gangrenous pancreatitis). The casualty statistics since that time from this cause have been augmented, but consist chiefly of the reports of individuals. Only a few surgeons have had a large number of cases of pancreatitis or in their articles on the subject have gathered together material other than their own. From the many scattered cases of various authors it is however not correct to draw definite conclusions and to deduce from them the ultimate results. As is natural the favorable results of a large number of operations have been published rather than the unfavorable. Villar, who also mentions this difficulty, found 67 recoveries and 63 deaths. After considering Villar's statistics, I found since 1905 the scattered records of 118 cases of operation for acute pancreatitis—73 recoveries and 45 deaths, a mortality of 38 per cent. When I cut from the list the cases which had been mentioned twice I found that I had 103 cases with 41 recoveries and 62 deaths, or 60 per cent. mortality.

		Recovered	Died
Eloesser-Czerny	3 cases pancreatic abscess	3	0
Eloesser-Czerny	1 case pancreatic necrosis	0	1
Eloesser-Czerny	3 cases hemorrhagic inflammation	0	3
Garré	7 cases	3	4
Hahn	4 cases	2	2
Doberauer	5 cases acute inflammation	1	4
M. Robson	4 cases hemorrhagic inflammation	2	2
M. Robson	6 cases suppurative inflammation	5	1
Notzel	8 cases hemorrhagic inflammation, necrosis, abscess	3	5
Coenen-Kuttner	5 cases	4	1
Tietze	6 cases	2	4
Seidel	10 cases	3	7
Deaver	6 cases	3	3
Mayo	3 acute cases	2	1
Morian	5 acute cases	0	5
Musser	5 acute cases	3	2
Kehl (Liebold)	5 cases	1	4
Neumann	9 cases acute pancreatitis	3	6
Neumann	8 cases necrosis	1	7
Total	103	41	62

It is at once evident that these lists of statistics are much less favorable and come much nearer the truth than did the first. (N. B. Reference may also be made to a number of further statistics which have been gathered out of the literature, viz.):

		Died	Per cent.
Quénu:	21 operations for acute pancreatitis	13	61.9
M. Robson:	59 operations for acute pancreatitis	36	61.0
Ebner:	36 operations for acute pancreatitis	19	52.7
Dreesman:	118 operations for acute pancreatitis	61	51.7
Nobe:	43 operations for acute pancreatitis	21	48.8

The percentages of mortality based upon these scattered cases are of only approximate value. In order to draw a therapeutic conclusion it seems to me better to consider my personal experience rather than to collate a greater number of observations by other authors. My material consists of 44 cases of acute pancreatitis and their sequelæ. Of these, 34 occurred in my division in the Krankenhaus am Urban and also in my private practice, while 10 cases came from the second surgical division of the Hospital which were seen and reported by Professor Dr. Brentano, to whom I wish to express my thanks for the permission to use his cases. In these cases, either through operation or through post mortem examination, often both, the diagnosis has been fully established. Besides these 44 cases there were 8 others in whom the clinical symptoms notwithstanding their favorable course warranted the diagnosis of acute pancreatitis. Of these 7 cases recovered and one died, without, however, a post mortem being obtained. As we have thus far no absolute pathognomonic signs in this sickness (the Cammidge reaction has been entirely negative in the acute cases) it seems best that the diagnosis of acute pancreatitis in these 8 cases should be considered merely as probable, since there was no autopsy either in life or after death. I have therefore omitted these 8 cases from this present series, in order to give the material considered the value of having been absolutely demonstrated.

Among the 44 cases, 38 were subjected to operation. In six cases no attack was possible. These have been considered merely from post mortem examination. Of the 38 cases operated upon, the diseased pancreas was directly attacked in 34 of the cases, while in 4 patients merely the concomitant disease of the gall passages received operative treatment. The experience of these four patients, all of whom died, indicates that in such attempts one should consider also the direct attack on the pancreas itself. Possibly one or another of the four cases might have been saved if at the same time the gall bladder was operated upon we had considered operative interference on the pancreas itself. Of the 34 operated patients in which either as the result of a correct diagnosis arrived at during the operation or as the result of prior judgment the diseased organ was immediately approached—18 recovered and 16 died. Of the entire 44 cases, 30 were males and 14 females.

The youngest patient was 16 years (Case 33—operated in acute stage and recovered). The greater number, however.

had reached the fourth or fifth decade of life. The oldest patient was 70 years (Case 29—operated in acute stage, died).

The previous history of the patients before the acute illness in which they were brought to us for treatment in the greater number of cases stated that they had suffered a greater or less degree of similar distress, for the main part, however, of a much milder degree which had been supposed to have been caused by various conditions. Many stated that for a long time they had suffered from stomach distress with occasional acute exacerbations, usually referred to as cramps in the stomach. In three cases (Cases 4, 10, 25) at post mortem, duodenal ulcer was demonstrated, in which it is possible that the earlier complaints of epigastric distress found their origin. Very frequently the trouble was diagnosed as gall stone colic, and indeed, cholelithiasis has, as we shall presently see, frequently been found as a concomitant of pancreatitis, and it is to this condition that we must ascribe the etiologic factor in many of the cases. In them there were histories of periodical attacks of colicky pain in the epigastrium, and the operation or post-mortem examination showed gall-stone or inflammation of the gall-passages to be present (as in Cases 24, 26, 28). In addition, in Case 4, the colicky pain continued even after the gall-stone had been removed and while the bile was draining from the wound. The post-mortem examination showed that there was an abscess in the head of the pancreas. Thus it must be appreciated that attacks of pain, which in their character and also as to their situation fully correspond to the typical gall-stone colic, can also be caused by disease in the pancreas. Indeed, acute inflammation of the head of the gland causes the common duct to be congested and consequently dilated from the distal obstruction, which in turn causes jaundice, all of which tends to confirm one in the diagnosis of gall-stones. Thus it must be remembered that the onset of jaundice is not a pathognomonic sign in all cases of gall-stones.

Localized tenderness does not suffice to differentiate exactly the affection from those of the gall passages, the duodenum or the pyloric region. The pain was for the most part in the middle of the epigastrium, and it must be remembered that it is here that the large sympathetic nerve ganglia are to be found, which transmit the sensitiveness from all of the points in this region. Therefore the attacks of pain in the epigastrium which occur in so many of the patients at the outset can be confused with other conditions in the neighborhood which give rise to similar phenomena, such as gall-stones, inflammation of the gall ducts, duodenal ulcer and ulcer of the stomach. However, in a certain number of cases one must realize that the sudden onset of inflammation of the pancreas is accompanied by a severe epigastric pain. It is seldom that there are no prodromata or at most very little symptomatology antecedent to the onset of acute pancreatitis (14 cases of the 44). In one case the conditions developed on the fifth day post partum (Case 15). Severe indigestion was twice given as the cause,—in six cases, the abuse of alcohol. It is not very evident that acute or chronic catarrh of the stomach forms conditions favorable to an inflammation of the pancreas. If this were an essential etiologic factor it would develop more frequently in the histories, which has not been the case. The acute illness as a rule becomes very marked, so that the patients can with certainty mention a particular day on which they were taken with the severe epigastric pain, belching and vomiting, so intense as to cause a marked liability to collapse. In other cases the acute onset was not so evident, and it was impossible to say exactly from what date the process began. The suffering is without question confined above the navel, and in this region there is a marked tenderness on pressure.

In consequence of the disturbances, and particularly that of inflammation of the peritoneum, the intestinal canal becomes affected, and therefore many of the cases have been diagnosed as intestinal obstruction. Indeed, the patients are usually referred with the diagnosis of peritonitis, perityphlitis, inflammation of the gall bladder or intestinal obstruction.

The correct diagnosis is not easily made in the acute stage. The one symptom which gives the most probable insight to the condition is that of tenderness across the middle of the epigastrium and the resistance over the pancreas, which I had the opportunity of pointing out in my first article in 1894. A tumefaction is occasionally to be felt after enemata have in some degree emptied the intestines. On the other hand, it may not be appreciated until the patient is anesthetized, at which time the strong contractions of the recti become relaxed. This, however, is not absolutely indicative that pancreatitis is present as in cases of an acute inflammatory process of the greater curvature of the stomach (ulcer or cancer) which may be on the point of perforation or of the mesocolon or in the mesentery there may occur similar phenomena to which may be added peritonitis in the upper abdomen which also presents a transverse tumor in the epigastrium. Any of these conditions may confuse the diagnostician.

However, these conditions occur but seldom, and their treatment is also surgical. When one meets with an acute inflammation of the upper abdomen in conjunction with a tender resistance in the epigastrium one may venture a tentative diagnosis of acute pancreatitis, and thereby settle the indications for an immediate attack. The Cammidge reaction has not been present in our cases of acute pancreatitis in the eight cases in which it was performed. In seven of these it was negative. It was done by the chemist of the hospital, Dr. Roma, after the method suggested by Cammidge. It is unfortunate that this reaction could not be obtained in the cases with which we are dealing, and thereby to some degree help us in the difficulty of diagnosing acute processes in the pancreas.

Another sign which occasionally appears during the course of an abscess of the pancreas is the appearance of sugar in the urine, which has however been but seldom present in those cases considered by us. The examination of the urine for sugar and albumin was naturally done in each case. In one case the sugar content was 6.95 per cent. (Case 8, recovery after operation). Twice sugar was found in the proportion of 2 and 2.5 per cent. (Cases 40 and 41, both died). Three times smaller amounts were found varying from 0.5 to 1 per cent. (Case 18 recovered; Case 20 recovered; Case 30 died). In the other two cases there were only slight traces of sugar obtainable. The recovery of sugar in the urine is, however, only of small value in the diagnosis of acute pancreatitis. Of particular interest is the occurrence of sugar in the urine in Case 2 (the first patient who was operated on by free lumbar incision and who recovered after the evacuation of a very large amount of sequestrated pancreas). The urine was, during the patient's residence in the hospital, frequently examined, and was free from sugar. One year and eight months after operation, however, on examination in the hospital, in February, 1895, 6 per cent. of sugar was found. By regulating the diet it cleared up quickly. The patient was very stout. On April 1, 1901, she passed into a condition of coma and died on April 3, 1901. The post-mortem report of Professor Benda showed a chronic thickening of the head of the pancreas, and while the body and tail of the gland were covered with scarred tissue, he concluded that the necrosis of the pancreas was not caused through the diabetes as the sugar appeared for the first time so long after the operation, but was rather inclined to the opinion that the disturbance in the pancreas had caused the diabetes to ensue. However, this is rather difficult to apply in the light of what the post-mortem examination showed, as there was still what seemed to be a large portion of the gland in a perfectly normal condition and actively secreting. One must also consider that the late occurrence of sugar in the urine might be consequent to some other condition than that of the pancreas.

The diagnosis before operation can only be made with probability owing to our lack up until the present time of any pathognomonic signs. Since we have observed a number of cases which presented the typical symptoms of epigastric peritonitis with subsequent inflammatory swelling posteriorly, and particularly in the left lumbar region, we have considered this possibly the most certain sign which offers itself to the diagnosis of acute pancreatitis.

It was present in 18 cases which were diagnosed before operation, from which one-half recovered. In 13 others, the diagnosis was made through the observation of spots of fat necrosis at the time of operation (7 recovered; 6 died). In three others which were operated without a diagnosis, the condition was first recognized during the post operative course due to the drainage of sequestra of the gland (2 recovered, 1 died).

It seems to be of interest to determine how long after the acute onset of the illness operative interference should be undertaken, and what influence over the outcome the site of incision had. This is difficult because of the variety of stages in which one finds the gland, so that it was not always easy to reckon the exact date of the beginning of the acute pancreatitis, as the patients came to us for treatment some time after the onset of their illness. In some cases we have noticed during the period of observation a varying course from improvement to relapse (as in Cases 20 and 34). Thus it is not always certain from which of the various methods of operative attack the changes in the patient's condition are to be ascribed. However, from the history of the patient, or from that obtained from their attending physician, the data below have been constructed approximately.

Operation was performed on the 34 cases during the following periods:

	Recovered	Died	Total
During the first week after beginning of sickness	8	4	12
During the second week after beginning of sickness	3	1	4
During the third week after beginning of sickness	4	3	7
During the fourth week after beginning of sickness	3	4	7
During the fifth week after beginning of sickness	0	4	4
	18	16	34

From this it is evident that of the 16 that were operated during the first two weeks after the beginning of the illness, the greater percentage of them recovered (11 recoveries; 5 deaths). Of the 14 operated during the third and fourth week, only one-half recovered; the four operated in the fifth to seventh week, all died. Therefore, the chances of the success of the operation are unquestionably best when it is undertaken during the first weeks of the disease. The situation of the incision is not directly responsible for the outcome of the case, but one must consider the much greater import of the condition of the diseased gland and therefrom elect the operation which should be performed.

The earlier operative interference is determined upon, just so much greater is the probability that we will meet with the acute stage, while the later the operation is undertaken, just so much greater is the likelihood that the condition of necrosis and peri-pancreatic pus formation is to be found.

In the earlier operation we see the serous or serosanguineous exudate in the abdominal cavity, accompanied by the small spots of fat necrosis, evidenced by the characteristic sulphur yellow, split corn to bean sized flecks, which immediately calls one's attention to the diseased pancreas. These necrotic spots in the abdominal fat are very readily appreciated and occasionally one meets them in the preperitoneal fat. In other cases, one finds them first in the greater or lesser omentum, and in the fewest number of instances one finds them only in the region of the inflamed pancreas, when they are first to be seen only when the gland is freely exposed.

In those cases in which the inflammation is principally retro-peritoneal and points already in the left lumbar region, it is in this situation that they are most likely to be found. The diseased organ is hard, swollen and more or less completely infiltrated with blood. We have only found one case which was operated on early in which large spots of softening were present (Case 29). This condition usually is ushered in later when the necrotic softening of the inflamed and infiltrated tissue has begun. In three cases (5, 24, 34) accompanying the inflammatory exudate and the spots of fat necrosis there was found merely an inflammatory swelling of the pancreas, which spontaneously recovered after sponging out and draining the exudate without the formation of any necrotic discharge.

The first case of this kind (Case 5) was operated in 1895 without our appreciating the nature of the condition, which was merely diagnosed as a gall stone colic, and from which the patient recovered. In the second operation, in 1896, for a common duct stone, in the same patient, we could find no signs of the former pancreatitis. The patient is living and is perfectly normal. This case at the time of operation was not correctly diagnosed, as at that time we did not realize the etiological relationship between pancreatitis and fat necrosis. In the light of my later experience, it is, however, unquestionable that we were dealing with acute pancreatitis, which in all likelihood was consequent to the presence of cholelithiasis. Case 34 gave us similar findings which was operated after repeated attacks of pain, without the finding of a gall stone, but there was marked induration of the head of the pancreas. After the operation the pain ceased and the patient recovered.

Case 24 was referred to me from Karlsbad after having passed through many severe attacks of pain, which were diagnosed as the result of gall stone. There were, however, none present, but a serous exudate, fat necrosis and severe inflammation of the head of the pancreas, which was incised in three places and drained. There was no recurrence of the pain, and three years after the operation the patient states that she feels perfectly well.

In eight cases (14, 17, 19, 20, 23, 28, 29, 33) operation disclosed acute hemorrhagic inflammation of the pancreas which developed in their subsequent course greater or lesser necrotic areas. Five of these recovered—three died. In three cases (21, 26, 27) we demonstrated an acute inflammatory exudate originating in the pancreas and localized in the neighborhood of the organ,—two of them in the left extremity (21 and 27), and one in the head and body of the gland. These inflammatory pseudo-cysts contained cloudy dark brown to black brown exudate. In Case 27 there was also fresh coagulated blood. In one instance (21) gall-stones seemed to be the etiological factor of the pancreatitis. In the second case (26) the gall-passages were free from stones and inflammation. In the third case (27) the gall bladder was not opened. The pain ceased immediately after the evacuation of the hemorrhagic cyst. The fat necrosis of the omentum stopped, and there were no recognizable pieces of necrotic pancreatic tissue thrown off.

Pus formation in the head of the pancreas and in the neighborhood of it was noticed in three cases (11, 18, 44), in all of which gall stones were present. The gland was in two instances treated by raising the duodenum, the abscess bluntly opened and drained. Both patients recovered. In the third patient a small abscess was opened in the head of the pancreas and drained. There was much fat necrosis present in the gastrohepatic ligament and behind the duodenum. The patient died eight days after operation. The autopsy showed inflammation of the pancreas and a fresh hemorrhage in the tail. In the top of the papilla of Vater a stone was found. An evident cause of death was not established. There was no peritonitis present.

There were three cases of abscess in the region of the inflamed pancreas which later went on to discharge pieces of necrotic gland (30, 31, 36). Of these, two recovered (30, 31) and one died (36) from hemorrhage. In one of the last cases operated (43) we found twenty-four days after the beginning of a typical illness a large left sided subphrenic abscess which was opened through an epigastric incision. This contained reddish brown pus and appeared to come from between the space between the liver and the stomach. There was no perforation of the gall bladder, stomach or duodenum, so that it was fair to infer that the point of origin was in the pancreas (the Cammidge reaction was positive in this case alone).

When we consider these cases together, in whom there was found inflammation or pus formation, but no evidence of necrosis of the gland, we have 21 operations undertaken in this condition, 16 of which recovered, 5 died.

Findings at operation	Recovered	Died	Total
With inflammation of the pancreas, fat necrosis and serous exudate	3	0	3
Hemorrhagic inflammation of the pancreas with later more or less discharge	5	3	8
Pus in the pancreas or in the neighborhood, without necrosis	3	1	4
Acute inflammation with formation of encapsulated inflammatory hemorrhagic effusion	3	0	3
Pus in the pancreas or in the neighborhood with later necrosis	2	1	3
	—	—	—
Acute inflammation without necrosis	16	5	21
Extensive necrosis of the pancreas with infiltrating pus	2	11	13

Considering the series of cases in which at the operation necrosis of the pancreas was present, with pus in the omental bursa or in the retroperitoneal tissue, it appears that in the latter class there were 13 cases with only 2 recoveries and 11 deaths. It seems to me reasonable to conclude therefore that the operations which were undertaken in the acute inflammatory stage of the pancreatitis offered a much better prognosis than those which were undertaken after the occurrence of necrosis. The position in the gland in which the necrosis began varies in various cases and seems in some instances to have been dependent upon the severity of the inflammation.

In considering further the cases operated we note that during the first week of illness there were 7 in which there was either inflammation or pus formation (5, 11, 24, 27, 28, 33, 44), without, however, any subsequent necrosis. Six of these patients recovered. There were four instances of hemorrhagic pancreatitis without necrosis. Of these three recovered (14, 19, 23), in which, however, during the postoperative course more or less sequestra of the gland was discharged. One patient (28) died two days after operation, in whom the post-mortem examination confirmed the operative findings. In one instance retroperitoneal pus and fat necrosis were found. The patient (36) died about one month after the operation from hemorrhage. The post-mortem established a very evident necrosis of the pancreas. In one patient we discovered four days after the beginning of his illness a cavity in the pancreas (29). The patient was seventy years old, and stated emphatically that four days previous, after having been entirely well, he had been suddenly seized with pain in the region of the stomach, vomiting, intestinal occlusion and collapse. He was admitted with the diagnosis of peritonitis. Owing to having a double inguinal hernia, of which that on the right side could not be reduced he was operated under local anesthesia. There was no evidence of intestinal stenosis in the hernia, but through the wound there escaped a brown nonodorous exudate, and fat necrosis of the omentum was noticed, because of which the pancreas was immediately exposed, and there was found in the head of the gland a cavity the size of a small apple, which contained some bloody fluid and detritus. The patient died three days later. The post-mortem examination showed a marked disturbance in the head and body of the gland for the greater part, and in the left part of the gland there were many small necrotic areas.

We found then up to the end of the first week inflammation or pus in the pancreas, which in some of the cases did not develop necrosis while others did. In only one instance was a spot of softening in the gland noticed in a patient operated on the fourth day. In the second week of this disease there was but one case in which an abscess was found without necrosis (18). In one there was a localized hemorrhagic inflammatory exudate, which later, during the course of convalescence discharged pieces of necrotic gland and later the formation of a fistula (26). In two other cases abscesses were found in the region of the softened gland. In the third week two cases of inflammation without necrosis were found at operation (31, 34). In a third case (20) a hemorrhagic inflammation was present, which after throwing off sequestra completely healed. In a fourth (21), retroperitoneal pus was found, which healed eventually after the discharge of a portion of the gland. Finally there were three cases (7, 10, 35) which died, in which there was a necrosis of the pancreas and pus formation in the neighborhood. In the fourth week, there were six patients operated in which the gland had been destroyed in the greater part, in all of which there was a discolored pus surrounding it. Two of these recovered (2, 8), the remainder died. In all cases operated after the fourth week necrosis and pus was always found and all the cases died. If we add to these the six cases which were not operated, and which were subsequently examined post-mortem, we found among them one on the third, and another on the fourth day, which showed very evident necrosis of the pancreas.

Thus it is shown by our material that even as early as the third and fourth day, necrosis can occur, and these cases have a very bad prognosis. In contradistinction we have had cases in the third week in which we have met inflammation. Some have been without necrosis, and there were others in which large portions of the pancreas were thrown off, which recovered. There were also cases which did not at all, or at least very late in their course, form necrotic material which was discharged. These are the cases which are most favorable for operation, and in whom the most favorable prognosis can be given. There are a certain number of cases in which it is impossible to say how quickly the inflammation will develop into necrosis, but nevertheless we feel justified in emphasizing the fact that the very earliest moment should be employed for the operation, as it has appeared that the greater proportion of these cases offered more opportunity of recovery, in which the inflammatory hemorrhagic infiltrated gland was freely exposed and incised early, rather than those which came to operation in the stage after necrosis had occurred.

There have been various ways undertaken in order to reach the inflamed gland and the pockets of pus. If the swollen pancreas is palpable as a transverse tender resistant tumor in the epigastrium, I have employed a median incision in the epigastrium by choice. After opening the abdominal cavity in those cases of acute inflammation the serosanguineous fluid is sponged out and the inflamed gland palpated. In a few cases it has sufficed merely to sponge out the inflammatory exudate and the inflamed pancreas in Cases 5 and 34 quickly recovered its normal condition. This course is justified only in the milder cases in which the pancreatitis has not gone on to necrosis or pus formation. These cases are certainly very seldom observed, however, and so it is a good rule to fully and freely expose the pancreas itself after a median incision.

The best approach to this gland is through the gastrocolic ligament, through which opening the inflamed organ can be plainly seen lying at the bottom of the omental bursa, when the stomach and liver have been retracted sufficiently. In occasional cases one can approach the pancreas from above the stomach by going through the gastrohepatic ligament. In this manner (26) an inflammatory hemorrhagic exudate was discovered, opened and drained, which lay behind the lesser omentum. One can also approach the pancreas by strongly retracting the incision which may have been made for inflammation of the gall bladder, after the duodenum has been mobilized, and thus inspection of the posterior portion of the head of the pancreas is made possible (12, 18).

One can also approach the pancreas through a semi-transverse gall bladder incision from above the lesser curvature of the stomach, and also anteriorly in the duodenal angle after the gastrocolic ligament has been divided. In case 24 all three of these methods of approach were used in order to expose the inflamed gland and to drain it,—as was also done in Case 44.

As it has been established that inflammation of the bile passages can pass through the papilla of Vater backwards into the pancreas, and that also the inflammation can originate by way of the lymphatics, one should always remember in such cases, at the time of operation, never to omit to make a thorough examination of the gall-bladder. If fat necrosis is present it is an absolute indication that the pancreas should be explored. In four cases where I attempted this, while not understanding the relationship, I found later at the post-mortem examination in two instances abscesses (12, 16). In one was found an abscess cavity containing a pancreatic stone (4), and in another, a hemorrhagic inflammation of the head of the gland (9). After these observations I learned to be more particular as to the examination of the gland in later cases with similar findings. When the inflammation is unquestionably on the left side in the neighborhood of the tail of the gland one must make a secondary longitudinal incision on the left side (21), or a left sided transverse incision after the method of Sprengel (27), in order to be able to expose that portion of the gland.

Brentano found in Case 31 on exploration through the anterior incision that there was a retroperitoneal collection of inflammatory exudate which he drained from both sides through a lumbar incision. The patient recovered after the discharge of sequestra.

One can also freely expose the gland from below through the transverse mesocolon after raising up the greater omentum and the transverse colon. However, I do not think this method of approach particularly advisable because of the number of great vessels which run through the mesocolon and the danger also of infecting the lower part of the abdominal cavity by such exploration.

If one operates in the acute stage before the occurrence of necrotic softening and peripancreatic pus formation, the gland on being exposed is found hard, swollen and greatly reddened with small spots of fat necrosis scattered about it. Occasionally there is present an encapsulated inflammatory exudate in the bursa or under the greater omentum. These should be walled off with gauze separating them from the free peritoneal cavity, incised and drained (21, 26, 27).

There are various ways of treating the pancreas itself. One may either introduce gauze strips and tubes down to the anterior surface of the inflamed gland, and thus provide for drainage of the secretion, or the inflammatory tissue may be invaded in various places with a sound or other blunt instrument, and in this manner the gland may be drained directly (14, 19, 20, 23 and 24 recovered; 28 and 29 died). In this manner through puncture of the body of the gland the tissue is so opened up that the intralobular exudate can drain off, and I am of the opinion that large portions of the gland can in many cases in this manner be prevented from becoming gangrenous. Drainage is also thus provided for the throwing off of smaller pieces of gland. The five patients operated on in this manner recovered, although there was present in each instance a very severe hemorrhagic infiltration of the gland tissue, and although healing took place only after the throwing off of some smaller pieces of the gland, there was no evidence of any extensive gangrene of it.

The gall-bladder may also be exposed from the median incision, and if it should be inflamed or filled with stones or pus, owing to the condition of the disease, it should under no consideration be at that time incised and drained. During the stage of collapse, one must be contented with at the most draining the region of the gall bladder, and only after the recovery of the patient should the gall bladder operation (cystectomy) be undertaken (as in Case 19). In four cases in which cystectomy was done, as indicated above, three recovered (20, 24, 35); one died (44). In two instances the bladder was opened and drained (14, 21). In the last case a cystectomy was done later.

Very much more unfavorable is the outcome when one finds at the time of operation that the gland is already in the state of necrosis. As a result when one approaches this condition at such a time from the front adhesions are as a rule present. If this is not the case one must immediately shut off the free peritoneal cavity by means of gauze packing. After approaching the pancreas through the gastrocolic ligament one usually comes upon a discolored purulent fluid filling the omental bursa, at the base of which there are frequently found large pieces of sequestra of the gland. After sponging out the contents, the cavity is filled with gauze and drained with a tube. In one case (7) a counter incision in the lumbar region was made. The results of the cases operated on in the state of necrosis and pus formation through an abdominal incision were without exception bad. There were in all 21 cases operated on through this approach. Of these 14 recovered and 7 died. In this series 5 patients, who were operated on in the stage of acute inflammation and softening of the gland, died (7, 10, 25, 29 [operated on the fourth day!] and 35). In contradistinction there were 15 operated on in the stage of acute inflammation or pus formation without necrosis. Of these 13 recovered, after the usual post-operative course of the throwing off of small sequestra and only two patients died —one (28) because of an accompanying nephritis two days after operation, and the other (48) eight days after operation from collapse.

The other method of operation in purulent inflammation of the pancreas and necrosis is by means of the lumbar incision. This is particularly indicated if the pus invades the retroperitoneal fat tissue and points in the left lumbar region. After a transverse lumbar incision underneath the twelfth rib the muscle is separated and the underlying peritoneum exposed, through which may be seen the necrotic material in the retroperitoneal fat tissue. After retracting the structures exposed toward the median line a blunt dissection is made at the lower pole of the left kidney into the retroperitoneal tissue, upwards and inwards toward the region of the tail of the pancreas from behind forwards. In this way the retroperitoneal pus is liberated and drained off. One is, however, unable to observe the actual condition of the pancreas itself through this approach. The lumbar incision is for the most part indicated in cases of pus formation and necrosis of the left half, and very infrequently because of inflammations of the head of the pancreas. The lumbar incision was employed in seven cases, of which two recovered and five died. The greater part were operated on in the stage of necrosis, viz., six, with five deaths, three from hemorrhage, and one recovered (Case 2). Only one was operated on in the acute stage (the tenth day) by Brentano through a left sided lumbar incision, who eventually recovered (30).

In combination with the median incision three cases were further approached by a lumbar incision, one recovered, two died. In Case 2, which was operated on by lumbar incision seven days after the beginning of the illness, a large and discolored brownish exudate was evacuated, which was also accompanied by fat necrosis. The fever and pain in the region of the stomach and the discharge continued, and because of this, twenty days after the first operation, the gland was approached a second time through a median incision into the omental bursa, which was opened from the anterior side, and was found to contain a thick yellow pus with necrotic pieces of fat and gland tissue. In consequence of this last operation the patient died the next day. This case was operated on in 1893, and was my first attempt at operating on the pancreas; it was done at a time in which there was little experience in this condition. At the present stage of our knowledge the median incision and direct attack on the pancreas would have been undertaken with much greater chance for a favorable outcome.

In Case 31, Brentano, on exposing the gland nineteen days after the beginning of the illness through a median incision, found a swelling the size of a fist behind the head of the pancreas. The abdominal incision was closed and the retroperitoneal collection of pus was opened into through a lumbar incision on both the right and left side. Recovery followed after profuse drainage and discharge of pancreatic detritus.

In Case 36, on the sixth day after the onset of the disease, Brentano exposed the gland through a lumbar incision on the left side, without, however, finding any pus. The pancreas was then exposed from in front and found markedly inflamed with an accompanying fat necrosis. The lumbar incision was then deepened and widened until it reached the region of the inflamed gland. From both wounds there followed a very profuse flow of pus, and through the lumbar incision some pancreatic sequestra was discharged. The patient died one month after operation from a hemorrhage from the wound. While in the first three cases of this class the anterior incision was made secondarily in order to freely expose the pus cavity, in the two other cases (31 and 36) the anterior approach was used more for verifying the diagnosis; the drainage of the inflamed gland taking place through the lumbar incision. In four other cases (8, 13, 32, 43) the inflammation and necrosis of the pancreas had gone on to the formation of a subphrenic abscess, either from a rupture through the omental bursa upwards into the subphrenic recess, or the infection had passed from the superior border of the gland through the gastrohepatic ligament, and thus passed directly into the same space. The diagnosis in such cases is peculiarly difficult as the focus in the dome of the diaphragm is difficult to reach. The subphrenic pus has to be diagnosed through means of an exploratory puncture, and following the cannula, a transpleural opening is made. One of these cases (8) subsequent to the discharge of necrotic pancreatic tissue with an accompanying diabetes recovered. Case 43 has nearly recovered; the two others died.

In Case 13, the diagnosis was in doubt for a long time, and it was nearly four weeks from the beginning of the sickness that a resistance in the epigastrium was noticed. Somewhat later an exploratory puncture (in the eighth intercostal space) disclosed a fetid exudate in the left pleural cavity and underneath the diaphragm. The operation involved a dissection of the eighth rib on the left side for exposure of the pleural cavity, and secondarily, an incision through the diaphragm into the subphrenic space and drainage from here of the pocket of pus. The resistance in the epigastrium remained, however, and so the omental bursa was opened from in front at the same sitting, and the necrotic pancreas drained directly through it. The patient died the same day. An earlier incision through the abdomen would have been much better. Unfortunately the physical signs were too vague, and thus the diagnosis was made too late. In the last case (32), which was operated on five days after the beginning of the illness, a lumbar incision on the left side was made, which disclosed necrotic foci in the retroperitoneal connective tissue, but no pus was found. The temperature of the patient remained up until the twentieth day after operation, when an exploratory puncture in the ninth intercostal space disclosed a pocket of pus under the diaphragm, which was opened through a lumbar incision. Seven days after this death ensued very suddenly. The post-mortem examination showed a marked necrosis of the pancreas which had ruptured through into the duodenum accompanied with hemorrhage.

The transpleural operation, which was undertaken in all three cases in the stage of necrosis and pus formation, resulted in one recovery and two deaths. Through the employment of the median abdominal incision through the epigastrium, a fourth case of subphrenic abscess was operated, which is, at the present time, nearly recovered (Case 43). In this instance, however, up to the present there has been no discharge of necrotic material.

SUMMARY OF THE VARIOUS METHODS OF OPERATION.

Abdominal Incision—Total 21	Recovered	Died	Total
In the stage of inflammation or pus, with much necrosis	14	2	16
In the stage of necrosis and softening	0	5	5
Lumbar Incision Alone—Total 7			
In the stage of inflammation with pus	1	0	1
In the stage of necrosis and pus infiltration	1	5	6
Lumbar incision in combination with anterior abdominal incision	1	2	3
Transpleural operation	1	2	3
	18	16	34

When one compares the results of the various methods of operation we find that there were 21 abdominal incisions with

14 recoveries and 7 deaths. There were 13 lumbar incisions, including the transpleural operation, with four recoveries and nine deaths. It is obvious then that the abdominal incision is without doubt the method which is to be advocated.

On more careful analysis of the cases, one, however, must appreciate that the best results are not merely the result of the method of operation employed alone, but are to a much greater degree dependent upon the peculiarity of the condition of the case at operation. Of primary importance, however, is the position of the incision. The abdominal incision was used in sixteen cases in the acute stage of inflammation or pus formation, although necrosis had occurred. Among these were a number of very severe inflammations, which subsequently developed during their course the discharge of sequestra of the gland (as in Cases 14, 19, 20, 23 and 24). There were others, however, in which the inflammatory reaction was much less severe which did not develop necrosis.

In these cases I wish to reiterate my opinion that the separation of the involved gland tissue prevented the onset of evident gangrene, and that when approached in this manner, offered a much better prognosis than those on whom the operation was performed in the stage of gangrene, as in five cases in the latter class, which were approached through the abdominal cavity, none recovered.

Further, the abdominal incision should be advised particularly in cases which are operated on relatively early, as was evident in the case of a patient operated on three days after the onset (44), who died eight days later in collapse. Also in two cases, two patients operated on the fourth day, one of which (28), although there was no necrosis of the gland, suffered, however, from a very severe nephritis.

A third case, which died (29), on the fourth day had a gangrenous cavity in the head of the gland.

The lumbar and also the transpleural incisions are on the other hand for the most part employed only in the later stages, and after the occurrence of gangrene and softening, as is indicated by the pointing of the pus pocket in the lumbar region or in the subphrenic cavity. Of these cases, two patients recovered, one operated on through the lumbar incision (2) and one through a transpleural incision (8). These are the only two cases in our material which have recovered as a result of the operation after the occurrence of necrosis. In the stage of pus formation before the beginning of necrosis, three cases were operated on through the lumbar incision. In two of these there was an abdominal incision made also. Of these two recovered (30, 32), while one died (36). There were then five cases in which the lumbar operation was undertaken during the first two weeks. Of these two recovered.

The same analytical study of certain cases shows us also that we must consider primarily as regards the prognosis, the kind of inflammation present, as well as the point of incision, and secondarily, the method of operation. We must then strive to advise early operation in acute pancreatitis, and I believe, taking everything into consideration, that the abdominal incision in the epigastrium is by all means the best method. We can through it empty the abdominal cavity of the inflammatory exudate, and even by this alone several cases have recovered. We can also further freely expose the inflamed gland. Pus or foci of inflammation can be recognized and opened, and finally, through the agency of drainage of the gland tissue itself or the surrounding region, the secretion can be carried off and the consequent discharge of material find an exit. Also, one can learn of complicating or concomitant conditions, particularly those relative to the bile passages, in which may be found the etiologic factors, and which one may wish to treat at the same time, which can be done from the position of this incision.

The lumbar incision is to be advised in those cases where one notices early retro-peritoneal invasion, which is best to approach from the side, but in such cases it may also be very advisable to open into the lesser peritoneal cavity at the same time, and freely expose the gland from in front. When we undertake operation in the later stage it has been our experience that the best method is to employ the lumbar incision (which includes the transpleural) as the one followed by the best results, from which procedure a few cases may be saved. The post-operative course is as a result very tedious. There is a good deal of discharge of small pieces of necrotic fat, and in eight cases during convalescence, large pieces of pancreas have been discharged.

There were four cases of fistula through which purulent pancreatic secretion was discharged. These healed spontaneously. The Pawlow-Wohlgemuth diet cure did not seem to influence these cases to any degree. In one case the descending colon prolapsed through a large lumbar incision. In another instance there was a fistula in this part of the intestine which recovered only after a plastic operation. The time of healing in all of those cases in which there was a discharge of necrotic pieces of gland or fistula formation, was very long—two to seven and a half months. In only a few of them in which there was such discharge was the healing completed before one and a half months.

The cases which have recovered we have followed very carefully for a long time, and they are all in the best of health, with the exception of the one mentioned previously, who finally recovered, after a severe necrosis, only to suffer a year and a half later with diabetes, which diagnosis was finally established at the post-mortem examination, eight years after the first illness, and which condition it was concluded could not have resulted from the pancreatic disease.

It is interesting to note the number of severe post-operative hemorrhages which occurred, six of which were immediately fatal, and in only one instance could it be stopped by tamponing. We have repeatedly noticed the large number of great vessels which run in the neighborhood of the gland. Of particular interest among these are the mesenteric vessels and the splenic vessels. The veins are very liable to thrombosis, and in four instances the splenic vein was found in this condition accompanied by large foci of metastatic abscesses in the spleen itself. The most severe hemorrhages followed the erosion of the larger arterial branches, particularly those of the upper border of the pancreas. One patient in whom we were able to stop the hemorrhage was a man of forty-five (14), who was operated on six days after the beginning of an acute illness, through a right rectus incision. There was much fat necrosis and serosanguineous exudate present in the bottom of the lesser cavity and a very severely inflamed pancreas was noted. The gland was drained through a rubber tube and gauze strips (it was not incised). Some 894 stones were removed from the gall bladder. After recovering from a very severe post-operative collapse there followed a profuse discharge of pus accompanied by necrotic tissue. Twenty-one days post-operative there occurred a very severe hemorrhage from the depths of the wound which was controlled by means of a tampon of iodoform gauze. Subsequent recovery followed.

In a second case (31), which recovered, there occurred frequent small hemorrhages from the lumbar incision on redressing the wound, which were easily controlled by packing. Both of these patients who suffered from post-operative hemorrhages, but who subsequently recovered, were operated on in the acute inflammatory stage. Both of them, however, discharged large portions of necrotic tissue subsequently.

In the six cases in which the arterial hemorrhage caused death, four were operated on by the lumbar route (1, 22, 32, 36) and two through an abdominal incision (10, 15). In one case, however (32), the blood discharged itself into the perforated duodenum. It was not always possible to exactly determine the vessel which was affected. Four times, however, erosion of the splenic artery was established as the cause of the hemorrhage. There are two other cases which were not operated on, in which there was evident retroperitoneal hemorrhage, as shown by the autopsy.

The following table indicates the time after the beginning of the illness in which the patient was operated and how long after the operation the hemorrhage occurred.

Case		Occurrence of hemorrhage
1	operated about the fifth week after beginning of illness	2 weeks post operat.
10	operated about the 20th day after beginning of illness	11 days post operat.
15	operated about the 28th day after beginning of illness	13 days post operat.
22	operated about the 6th week after beginning of illness	4th and 13th days post operat.
32	operated about the 4th week after beginning of illness	27 days post operat.
36	operated about the 5th day after beginning of illness	34 days post operat.
14	operated about the 6th day after beginning of illness	21 days post operat.

From this it is to be noted that the hemorrhage always occurred in the stage of necrosis and pus formation. Further, that it occurred in two cases which were operated on quite early, and both of which, however, subsequently discharged freely necrotic material. This liability of hemorrhage from the larger vessels is not to be lightly disregarded in those cases of acute pancreatitis which subsequently become necrotic. Early operation seems to reduce this danger considerably, but only so far as an early exposure and drainage of the inflamed gland prevents the subsequent development of tissue destruction. If this condition, however, does develop and goes so far as to create a lesion of the greater arterial vessels, we can only rely on the introduction of a tampon of iodoform gauze to stop the bleeding, accomplished once out of seven cases in our series. It is absolutely impossible to recognize and find the blood vessel in the depths of the wound.

Of those cases which died after the operation, five died on the second and third day, five on the seventh and eighth day. The remainder scattered through the time from the tenth day to the second month. In those which were not operated, the illness continued from the beginning to the death of the patient—3, 4, 5, 7, 11 and 12 days respectively. One patient (38) lived fifty-one days. This patient was a very obese woman who came first under our notice fourteen days after the beginning of the illness, at which time she was suffering from an active bronchitis, which quickly developed into pleuropneumonia, contraindicating any operative procedure. Post-mortem examination showed inflammation of the entire pancreas which had ruptured through into the intestine, and an accompanying endocarditis and pulmonary embolism. From the findings at autopsy it was evident that in all of the cases there was a very extensive disturbance of the pancreas present. In two instances there was a typical duodenal ulcer, which had ruptured through into the pancreas, and which undoubtedly formed the etiologic factor of the subsequent inflammation which caused the death of the patients (10 and 25).

In three of the cases the pancreatic abscess had ruptured through into the intestines, duodenum and colon. In three other cases the pus had ruptured through into the free peritoneal cavity.

It is of further interest to note how many of our cases of acute pancreatic inflammation were concomitant with cholelithiasis or inflammation of the gall passages.

Of the entire forty-four cases (the operated as well as the non-operated, the latter of which, however, were all observed at autopsy) in twenty-two, or 50 per cent. of the cases, disease of the gall passages was present. In twenty-one of the cases, cholelithiasis and in one infectious cholecystitis without stones was found. In six cases there was no direct exploration of the gall bladder, and in these it is questionable, therefore, whether there was any trouble there or not. In five recovered cases, which included four with the lumbar incision and one with a high epigastric incision, the exploration of the gall passages was impossible, and in one case of lumbar incision where the patient died, no post-mortem examination was allowed. In these six patients it therefore remains questionable whether cholelithiasis was present or not. Three of these had typical histories of gall stone colic, but as it was previously pointed out, these gall stone colics can be simulated by pancreatitis, without the presence of any gall stones or inflammation of the gall passages. In sixteen cases, either through exploration at operation or at the post-mortem examination, stones or inflammation of the gall passages was demonstrated. The appended table covers the concomitant pathologic conditions in the forty-four operated cases which includes those on which post-mortem examination was made.

Cholecystitis with stone	1	22 times
Cholelithiasis	21	
Diagnosis of stone or inflammation in the gall passages obtained subsequently		16 times
No absolute evidence		6 times
An etiologic correlation between the disease of the bile passages and the pancreas was seemingly evident		18 times

In three instances stones were present in the papilla—in two of these (18, 21) the stones were removed at operation. In the other (44), the stone was found at post-mortem. These stones completely occluded, as in the case related by Opie, the duodenal opening of the papilla of Vater. In the base of the diverticulum of Vater, the mouths of the gall duct and the pancreatic duct opened adjacent to each other. Here were found three instances of common duct stone, in one of which there was an accompanying stone in the gall bladder. In eleven instances the stones were found at the time of operation. In seven cases it seems reasonable to infer that from the post-mortem examination the disease of the pancreas was consequent to that of the gall passages.

Regarding the dependency of pancreatitis on the presence of cholelithiasis there has been much written lately. Osler found 105 cases of pancreatitis complicated in 45 instances with cholelithiasis. Egdahl found practically the same relationship, 105 cases with 45 instances of stones. Quénu similarly found 128 cases complicated by 47 instances of gall bladder involvement. Kehr had only found in his large experience with gall stones five instances of necrosis of the pancreas at operation (one recovered, four died). Truhart does not agree that all cases of pancreatitis are consequent to gallstones, and this certainly seems correct in some cases, but in those cases in which inflammation of the gall passages has been established by operation or post-mortem examination, or where there was a stone in the common duct or where the papilla was occluded, it seems to me quite reasonable to ascribe the pancreatic inflammation to these factors. I wish, however, to emphasize the fact that in every operation which is undertaken to relieve inflammatory disease of the gall passages, it is very important to examine the pancreas at the same time, and if it is found necessary the gland should be fully exposed and the foci of disease in it opened and drained.

In a like manner, when operation is undertaken for acute pancreatitis it is of greatest importance to examine the gall passages, and if one should find these inflamed or containing concretions, these conditions should be operated at the same time if the condition of the patient warrants it. More complicated procedures, such as cystectomy or the extraction of a very deeply situated common duct stone, should only be undertaken in those patients of marked strength. Otherwise it should be deferred to a later date.

From these observations the more obvious conclusions are as follows:

The diagnosis is in many cases of acute pancreatitis very uncertain, and can never be made absolutely, owing to our not having as yet found any pathognomonic sign. Of the entire picture the peritoneal inflammation is probably the most prominent feature. The greater number of surgeons consider the presence of peritonitis, in our present knowledge of the subject, as an indication for operation, and in these cases, in looking for the point of origin, the pancreas should be considered, and particularly so when the inflammation is confined to the upper abdomen. The finding of an odorless serosanguineous exudate, and even of greater importance, the discovery of small flecks of fat necrosis, is direct evidence of inflammation of the pancreas. Early operation in this affection is of the greatest importance, and the results of it are much better than of those undertaken in the later stages. Of sixteen operated on during the first week after the beginning of the illness, eleven recovered, while five died. Of fourteen operated on in the third and fourth week, one-half died. Of those operated on in the fifth to seventh week, all died.

In opposition to early operation, we must consider that the diagnosis is uncertain, and it is very difficult, particularly so for those with little experience, but as the physicians are sending their patients with peritonitis to the surgeon earlier, it is to be hoped that those with acute pancreatitis will also be sent correspondingly early. But we must appreciate that the early operation in this sickness is not by any means accompanied by such certain results as those undertaken in cases of appendicitis or in cholecystitis, whereby a timely operation and very favorable results can in the great majority of cases be prognosticated.

From my experience, it seems to me of much greater importance to consider the quality of the case and the intensity of the inflammation which we can only infer otherwise. The best results are obtained in those cases where the operation has been undertaken before the occurrence of severe irreparable changes in the gland. The best results were obtained in those cases which did not go on to necrosis, and also in those with encapsulated inflammatory hemorrhagic effusions in the neighborhood of the inflamed gland. Good results are also obtained in those cases of localized pus pockets in the pancreas or in those in which there was a very limited necrosis, as in the acute hemorrhagic inflammations. (Of eight of these, five recovered after the operation.)

A much more unfavorable prognosis is to be given to those cases which are operated on in the stage of extensive necrosis with peripancreatic pus infiltration. Of thirteen of this class of cases, only two recovered. From this it is fair to infer that only a small number of cases of acute pancreatitis reach the stage of necrosis, the majority dying from the acute inflammation before that condition is reached. From the foregoing it is evident that we must strive to operate before the occurrence of gangrene of larger portions of the gland takes place, to drain off the secretion, and, where it is possible, limit the advance of the necrosis. The accomplishment of this measure is, however, more difficult in some cases because of the fact of the very rapid necrosis of the inflamed and hemorrhagic infiltrated gland. In fact, three or four days after the beginning of the illness it is possible in a few cases to find the gland already advanced in necrosis.

The median incision in the cases undertaken in the early stage is by all means the one to employ, as we can thus reach and treat the diseased organ and also the gall passages best. The peritoneal exudate should be immediately sponged out or washed out with hot saline. The pancreas itself should in every case be freely exposed, best through the gastrocolic ligament or from the right side by the liberation and retraction of the duodenum. The approach through the transverse mesocolon is seldom to be advised.

The important thing to consider in all operations in acute pancreatitis is that all unnecessary manipulation of the inflamed parts should be minimized, as the danger of collapse is otherwise markedly increased. The quicker one recognizes and exposes the seat of the disease, namely, the inflamed pancreas, just so much better is the prognosis. The exposed organ is, after breaking through the peritoneal covering, incised with a blunt instrument and drained with tubes and gauze strips.

The gall passages are also at the same time to be freely explored for inflammation or empyema. The lumbar incision should be reserved for those particular cases in which there is a retroperitoneal collection of pus, and also in the few cases which are operated on in the later stages. Unquestionably the retroperitoneal effusion can best be drained by timely lumbar incision. Pus in the subphrenic space is, as indicated heretofore, best reached through an incision in the epigastrium, and in questionable cases can be sufficiently drained through a transpleural operation.

In the stage of abscess formation, hemorrhage from the pancreatic and neighboring blood vessels is a very positive danger, and one which is not entirely obviated through the early operation. Also thrombosis of the larger venous channels occurs, with its consequent septic sequelæ. The pancreatic fistulæ which develop in the occurrence of tissue necrosis in acute pancreatitis have the tendency to heal spontaneously. The Pawlow-Wohlgemuth diet cure should be employed in each of these cases. Most surgeons are in accord in the main with these principles which I have established from the analysis of my material.

There are, however, a few points which are as yet unsettled, and which can only be determined by a more extensive experience. Dreesman stated at the Surgical Congress in 1909 that mild cases of pancreatitis can recover. This I agree with, and believe that among the great number of instances of stomach complaints, termed stomach and intestinal catarrh, etc., there will be found not a few which are due to one of the milder affections of the pancreas, which have gone on to spontaneous recovery. There are many places where such patients are treated with benefit, such as the renowned Springs at Carlsbad, Vichy, Neuenahr, Homburg, etc., as Pawlow has shown that sodium solutions very markedly influence the activity of the gland. I have myself seen in four instances, and Brentano records three cases, which we consider healed pancreatitis. The accuracy of the diagnosis is, however, questionable, and this must continue so until we discover some pathognomonic sign in this disease.

One can also raise the question, might not those cases in which the abdomen was opened and the exudate drained, and which healed, have recovered without any operation? This is extremely difficult to answer. Hahn, who has had a large experience and who is a careful observer, had one case which impressed him before operation as being in a dying condition, and he was surprised when the patient recovered. Halsted had a similar experience.

There are also inflammations which seem to tend to develop toward the back and which cause very severe symptoms. The release and drainage of this toxic peritoneal exudate will certainly increase the chances of recovery. The uncertainty of the diagnosis being correct should lead one to operate only in those cases where the symptoms are increasing in their severity, for as yet we are very far from being able to say that a patient has a mild case, and will recover without operation. As we have learned from further experience, some patients, after having passed through previous milder attacks, were suddenly seized with very severe distress, which had to be treated surgically, as the expectant or palliative treatment gave no result. In the very severe cases of pancreatitis and also in those of severe hemorrhage, which quickly developed necrosis, there has been no success reached as yet from operating. Various surgeons, such as Robson and Deaver, deduced, therefore, from these cases that operative interference should not be employed. The case of Rasumowski is, I believe, reported incorrectly as being a case of apoplexy of the pancreas, which would hardly come under that category when one judges it from the operative finding. The patient, a man twenty-nine years old, was attacked with the typical symptoms of acute pancreatitis immediately after a meal. The symptoms remained stationary and continued, but he was able on the twenty-first day after the beginning of his illness to travel several hours to his home. He was operated on the twenty-fifth day, and a fluctuating tumor discovered behind the gastrohepatic omentum, this was opened and found to contain a dark syrupy fluid with some blood clots. This was drained. There were no necrotic pieces of gland discharged, and the pancreatic fistula, which remained open five months, closed after the discharge of a ligature thread. I should classify this case as one of acute hemorrhagic pancreatitis, which had gone on to the formation of a peripancreatic tumor. In apoplexy of the pancreas one should consider those cases in which there is a very marked disturbance and infiltration of the gland tissue throughout a large part of its extent, which progresses rapidly to death through the continued bleeding into the gland. This was not the case in the patient operated by Rasumowski, which was done in the fourth week of the illness and did not discharge any necrotic pieces of gland. Niemier's idea that a very acute hemorrhage of the pancreas should be incised and tamponed has until now, as far as my knowledge goes, not been followed by any good results.

There are many methods in vogue regarding the treatment of the pancreas itself. The first operations for acute pancreatic disease were undertaken mostly under the diagnosis of " intestinal obstruction," and thereby much time was lost through searching the abdominal cavity, and the ever-present inclination to collapse of these cases was greatly increased. In the great majority of cases with such a condition it is very desirable to merely incise the abdomen and remove the exudate. This was satisfactory in the cases of Hahn and Halsted. Hahn drained with iodine gauze strips; Halsted closed the abdomen without drainage, as did Flynn. All of these cases recovered. While, however, in a certain class of cases this simple treatment is sufficient, it does not hold good for all cases, as in the case of severe pancreatitis which has developed necrosis, or the formation of pus. In such the simple draining off of the peritoneal exudate would be of little moment.

There have been several observations also to show that after this simple operation there have been later ones found necessary in order to cure the abscess which has formed or to remove the necrotic sequestra (Barling, Dreesman, Russel, Alsberg-Dreifuss, Bardenheuer, Ebner-Lexer, Noetzel, all of whom put forward the necessity of going directly down to the diseased organ).

At present most surgeons emphasize the necessity of freely exposing the inflamed pancreas, while there are only a few who are willing to content themselves with merely running drains and gauze down to the outside of the gland. Others counsel direct incision in the diseased organ. I personally believe that the last method is preferable, as I have previously indicated, and by employing it, believe that the inflammation may be modified and the actual necrosis anticipated. Statistics on this point, however, are not large enough yet to draw any absolute conclusions therefrom. Accidental occurrences must certainly play a large part in each case, as must also the intensity of the inflammation in certain cases and the bodily resistance of the patient, as, for instance, great obesity, which unquestionably enters into the prognosis. In any event, this question is only of importance in those cases which are operated on in the acute inflammatory stage. As in the cases of abscess or necrosis of the pancreas the incision into the inflammatory focus or the eventual searching of the diseased gland itself is out of the question.

A few surgeons, Henle, Albrecht, and Tietze, have done a colostomy in order to empty the bowel, with good result. Henle has not even freely exposed the pancreas, and it is interesting to conjecture in that case if the patient might not have recovered without operation. There is no doubt but that the emptying of the bowel is very desirable, but the question is, will not the intestinal function re-establish itself spontaneously after the removal of the exudate? Although the four cases operated on by the previously mentioned surgeons recovered after a colostomy had been done, I do not believe that this method of treatment should be counselled as a regular procedure in operations for acute pancreatitis.

While most of the patients who recovered from their operation have remained in good health, there are reports from a few surgeons that in their patients, after a longer or shorter time, a renewal of the disease in the pancreas took place, which necessitated a second operation. (Beck, Bardenheuer, Porter, Haenel.)

The variability of these cases is very great, and I feel that the tact of the operator in certain cases must play a large part. In any event, since 1894 there has been a very great progress in our knowledge of the treatment of acute pancreatitis, since before that time these cases were regarded as rarities. Now they are being discovered with increasing frequency, and the diagnosis being made with greater surety, as our methods of diagnosis are advancing. The number of those recovering after operation is increasing each year, and thus, through the advance of our knowledge gained from the result of the treatment of the cases already mentioned, we hope that still more may be saved. The greatest advance, however, will be the discovery of a pathognomonic reaction which will positively indicate to us a disease of the pancreas.

THE INCISION FOR LUMBAR EXPOSURE OF THE KIDNEY.

BY WILLIAM J. MAYO, M.D.,
OF ROCHESTER, MINN.

It is a common experience when operating upon the kidney to find that a lumbar incision does not give adequate exposure of the pedicle, since the greater part of the kidney in the average case lies deep beneath the rib margins. Because of its anatomic relationship, the twelfth rib is the chief obstacle to a proper exposure, and for this reason many surgeons, myself included, have cut the rib when necessary, being rewarded by a remarkable increase in the operating space. In order to obtain the best results, the rib was cut as far posteriorly as possible and in doing this the pleura was accidentally opened in a considerable number of cases.

During the past two years (Nov. 1, 1909, to Nov. 1, 1911) we have performed 256 operations on the kidney. Of these, 203 were made through a lumbar incision, 7 were transverse, and 46 anterior transperitoneal. In the 203 lumbar incisions, it was found necessary to cut the twelfth rib in 51 cases and in 13 of these the pleura was accidentally opened. It is a fact worthy of note that in not a single instance did the lung collapse or any harm result to the patient from opening the pleura. When the pleural cavity was opened the air entered and escaped freely as the patient respired. In some instances the rent in the pleura was so large that the lung could be seen easily as it advanced in the act of respiration.

The operations were all made with the patient lying nearly flat on the abdomen with a moderate elevation of the loins. This position apparently serves to fix the chest so that, if the pleura be opened at the extreme lower part, collapse of the lung does not often occur. Whenever the pleura was accidentally opened we immediately sutured the opening with catgut, taking in the margin of the diaphragm, the cut pleural margins, and the posterior muscles with a running suture. The pleural cavity was not infected in any of our cases, although a septic condition of the kidney was present in some of them, nor did the entrance of a certain amount of blood into the pleural cavity give rise to unusual symptoms. No pulmonary complications occurred in any of these cases.

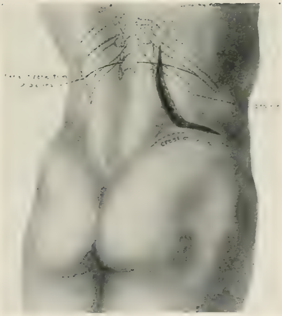
It seems evident, therefore, that with the patient lying prone, accidental opening of the pleura in exposing the kidney through the lumbar region is by no means a serious matter, yet this particular bugbear (pleural injury) has been one, if not the chief, obstacle to making a rational incision for the proper exposure of the kidney through the lumbar region.

In a number of cases during the past two years, while exposing the posterior half of the twelfth rib for the purpose of division, we observed that as soon as the muscular and fibrous attachments, especially the quadratus lumborum and the lateral arcuate ligament which binds the twelfth rib to the transverse process of the first lumbar vertebra, were divided the necessity for rib division disappeared. By putting a retractor under the angle of the twelfth rib, the upper margin of the incision, including the rib, was so mobilized that exposure of the kidney and especially of the kidney pedicle was quickly accomplished. The pleura was easily pushed upward and not opened. In two of the cases, when the costal margin could not be sufficiently mobilized, the twelfth rib was broken with a lateral twist and pull of the hand, causing an incomplete fracture within its periosteal and muscular coverings near the neck, and in one very obese patient the rib was cut.

In some cases the twelfth rib is absent or rudimentary, but this is quite immaterial so far as the advantage to be gained from the high posterior cut is concerned. The incision is made as follows:

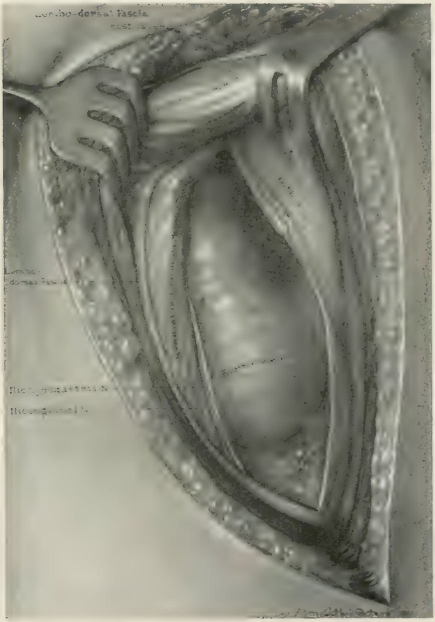
Beginning at a point two to two and a half inches lateral to the dorsal spines near the outer margin of the erector spinæ muscle, a longitudinal incision is made two to three inches in length through the skin, superficial fascia and posterior layer of the lumbodorsal fascia (vertebral aponeurosis) which covers the erector spinæ muscle. The incision lies

FIG. 1.



Lumbar incision for the exposure of the kidney.

FIG. 2.



Kidney exposed through lumbar incision.

behind the twelfth rib from the angle, if present, nearly to the head, and reaches downward to a point one-half inch below the angle. From this point the incision passes obliquely downward and forward along the anterior margin of the quadratus lumborum muscle to a point an inch above the crest of the ilium, and there turning runs forward parallel to the iliac crest as far as necessary.

The posterior superior lumbar triangle (Kelly) just beneath the twelfth rib is then exposed by cutting an opening through the external and internal oblique, transversalis, and latissimus dorsi muscles, exposing the transversalis fascia in its lumbar portion. This fascia is then opened freely, exposing the perirenal fat. The ilio-inguinal and iliohypogastric nerves are identified and retracted out of harm's way and the lower part of the incision completed. The twelfth rib is then cleared in its posterior portion upward and backward nearly to the articulation of the rib with the transverse process of the twelfth dorsal vertebra, and the pleura pushed upward. By retracting the erector spinæ muscle on the one hand and the costal margin on the other, a wide exposure is accomplished at the point of previous inaccessibility. As a rule the kidney can readily be drawn through the incision to the surface with but little traction. The incision is easily closed and there is little or no danger of hernia.

The incision herein described varies from the ordinary lumbar incision only in relation to the exposure above and behind the curve or angle of the posterior half of the twelfth rib.

In operating upon kidneys which are not greatly altered in size, or in which the alteration in size is due to fluid contents which can be evacuated, we prefer the lumbar incision.

For those tumors of the kidney which present themselves as a distinct abdominal mass the anterior transperitoneal incision is best.

An extended search of the literature of incisions for lumbar exposure of the kidney has not been made, but the method is so efficient and sensible that it is probably one of the old good things which has been forgotten.

EPIGASTRIC HERNIA, A CAUSE OF CHRONIC DIARRHŒA.

WITH REPORT OF A CASE.

BY FARRAR COBB, M.D.,
OF BOSTON, MASS.

Assistant Visiting Surgeon to the Massachusetts General Hospital.

It has never been taught, so far as the writer can discover, that a chronic diarrhœa can be caused by an epigastric hernia. The following unusual case teaches this important, and what is regarded as a *new* clinical fact. It has been known that an epigastric hernia is not infrequently the cause of gastric symptoms, epigastric and abdominal pain, nausea and vomiting, which symptoms are made worse by taking food or by exertion. This knowledge has been spread by numerous writers in the last fifteen years, but that a persistent and incurable diarrhœa, without gastric symptoms and without abdominal pain, could be due to such a hernia has never been reported or understood. Medical men have overlooked frequently this form of hernia as a cause of serious stomach symptoms. No doubt such herniæ have been an unrecognized cause of no inconsiderable number of cases of so-called incurable diarrhœa. The purpose of this article is to make it plain that a careful search for epigastric herniæ must be made in all cases of chronic diarrhœa of doubtful origin, as well as in cases of gastric disturbance.

By epigastric hernia is meant those small protrusions, usually not larger than a walnut, situated in the linea alba between the umbilicus and xiphoid cartilage. This form of hernia is rare, occurring in not more than 1 per cent. of all herniæ. It occurs much more frequently in males than in females. It usually contains omentum and rarely a portion of the transverse colon. Many of the cases develop slowly and insidiously, and suddenly give rise to symptoms. Cases accompanied by symptoms have more or less extensive adhesions to the abdominal parietes, transverse colon, or stomach. Far too little prominence has been given in text-books to this condition. It is frequently overlooked in the examination, and not many general practitioners understand what severe symptoms it can cause. For a study of etiology, development, and structural peculiarities of this form of hernia, as well as a complete discussion of the subject, writers are referred to the admirable articles by Lothrop, Lindenstein, Capelle, and others.

With regard to the symptomatology, all writers agree that the symptoms caused by this form of hernia are referred to the stomach and are always associated with pain; this pain may be constant, but is usually intermittent and is accompanied by vomiting and digestive disturbances. The only mention in literature, so far as is known to the writer, of intestinal disturbances as distinct from gastric in such cases, are two cases reported by Lothrop, both of them cases of acute colitis coincident with the hernia, one untreated and one cured by medical treatment, neither of them operated on. In neither of these could the hernia be considered as a cause.

REPORT OF A CASE OF CHRONIC DIARRHŒA YIELDING TO NO FORM OF MEDICAL TREATMENT, CURED BY OPERATION ON EPIGASTRIC HERNIA.

R. Y. N., sixty-nine, white, an intelligent Yankee farmer, was first seen by me on April 26, 1908, at Scituate, Mass., in consultation with Dr. T. B. Alexander. He came from a long-lived race with no family history of disease. Has always been a hard worker, and has always lived in the neighborhood. His habits have been good; no venereal disease; no excess of alcohol or tobacco. Has never been sick, except for last twelve years has been somewhat troubled with eczema on both legs. For seven months has had constant diarrhœa, for which no cause could be found. Has had from six to fourteen soft, watery movements every twenty-four hours. Very rarely he has gone all day without a movement, but when he has done so invariably at three or four o'clock in the morning he would wake up with an imperative desire and would then have from three to five movements in rapid succession. Has never passed blood to his knowledge, but for the last three months has noticed occasionally when straining to pass urine would have an involuntary movement of the bowels. Has never had any pain or griping with the diarrhœa nor any vomiting. Has never had a cough, but occasionally has some dyspnœa on exertion. At one time he limited his diet, living mainly on eggs, milk, and toast, but recently has eaten everything because he found that dieting made no difference in the diarrhœa. Has lost much weight. His normal weight being about 150 pounds, now weighs between 110 and 115 pounds. Aside from the emaciation and weakness and the annoying eczema, he feels well.

On February 6, 1908, two and a half months before I saw him, he entered the medical wards of the Massachusetts General Hospital. Previous to that he had been a patient in the out-patient department of the same hospital, and had been treated regularly there without improvement for three months. He was in the wards for three weeks, and left the hospital no better than when he went in, notwithstanding the many and different forms of treatment which he received. Since leaving the hospital, he has had just the same kind of diarrhœa, with the same number of watery movements daily. Since then he has given up any form of treatment and all dieting. He and his family regard his case as incurable and frankly express their distrust of doctors and hospitals.

Examination found an epigastric hernia about the size of an English walnut two and a half to three inches above the umbilicus in the median line. This was tense, gave a slight impulse on coughing, was irreducible, and not tender. Because no other cause for his diarrhœa could be found, and because it had yielded to no treatment, it seemed probable that it might be due to this hernia.

The following notes on his physical condition are from the medical and surgical records of the hospital: A muscular old man showing obvious emaciation. Heart and lungs negative. Considerable degree of arteriosclerosis. Abdomen full, soft, tympanitic throughout, no masses, no tenderness. Spleen not felt, knee-jerks normal. In scrotum small swelling about size of grape above the testicle, apparently connected with the cord, not tender and of no importance with regard to hernia or diarrhœa. Rectal examination negative. Temperature normal, pulse 80, of good quality. Respiration 27, hæmoglobin 80, white count 5000. Blood-pressure 160. Blood smear: polynuclear 55⅔ per cent.; lymphocytes, 16⅔ per cent.; large mononuclears, 24⅓ per cent.; eosinophiles, 4 per cent.; mast cells, one-third of 1 per cent.

During the first ten days in the medical wards the urine showed a slight trace of albumin and a few hyaline and finely granular casts, but at the end of twelve days the albumin and casts had disappeared. When he was on the surgical service his urine had no albumin or casts. Frequent examinations of his stools showed always the same condition—watery, brownish-black, guaiac test negative, no eggs, parasites, or amœbæ. The stools remained negative, notwithstanding the different kinds of medicine given and the changes in the diet. During the three weeks he was in the medical wards the patient had from three to eight watery movements daily. He was given different kinds of medicine, bismuth subnitrate, bismuth salicylate, pil. camphor, opium and tannin, tannigen, betanaphthol, Squibbs' diarrhœa mixture, codeine, etc. Diet varied from boiled milk to liberal house diet. The final conclusion was that his case was one of chronic diarrhœa of doubtful etiology not amenable to treatment. "A discouraging case not likely to improve, probably due to some chronic irritation in the colon." So reads the record!

Patient left the medical wards on February 27 and re-entered the hospital on the surgical side on May 6 following. The surgical records on his physical examination add nothing to the medical records, with the exception of noting the presence of the small epigastric hernia.

It was my intention, because of the arteriosclerosis and the advanced age of the patient, and the fact that previously for a short time the kidneys had shown signs of interstitial nephritis, to operate under local anæsthesia. This, accordingly, was tried.

An incision 2½ inches long surrounding the hernial tumor was made under local anæsthesia. A peritoneal sac surrounded by much fat was found. This sac contained omentum which had come through a small hole between the recti muscles. It was then necessary to give the patient ether because of the pain caused by manipulating the sac and omentum. Further exploration showed the omentum to be strongly adherent to the parietal peritoneum as well as to the peritoneum of the hernial sac, and that it also bound by strong adhesions the transverse colon firmly against the abdominal wall at the hernial opening. After tying off and dividing the adhesions, the transverse colon could be displaced freely in any direction. Before this was done it had been firmly fixed to the abdominal wall. The wound was approximated in layers, the fascia over the recti muscles being overlapped in a longitudinal direction. Pagenstecher thread was used to suture the peritoneum to the fibro-aponeurotic structure.

The patient recovered after a moderate wound infection and after going through some ether bronchitis on the third and fifth day. At no time after the operation did he have any recurrence of the diarrhœa, nor did he require cathartics to have regular movements of the bowels. The bowels acted normally and have continued to do so ever since. There has been no recurrence of the hernia.

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A STUDY OF SPRAIN-FRACTURE.*

BY GEORGE G. ROSS, M.D.,

OF PHILADELPHIA,

Surgeon to the Germantown and Stetson Hospitals; Assistant Surgeon to the German and University of Pennsylvania Hospitals,

AND

LEVER FLEGAL STEWART, M.D.,

Resident Physician in the German Hospital of Philadelphia.

SPRAIN-FRACTURE, a condition resulting from an increase in tension on tendon or ligament, or from direct violence at the seat of tendinous or ligamentous attachment to bone, is a separation of all or part of that bone to which tendon or ligament is attached, from that bone of which it formed a part.

Callender,[1] in 1870, first described " cases in which some ligament is torn, carrying with it a film or shell of bone into which its fibres are inserted," and called them sprain-fractures. Keen, in 1874, referred to the same pathological condition as " masked fracture." Ross and Wilbert [2] in 1902 drew attention to sprain-fractures in connection with so-called sprains. Bennett [3] in 1906 said, " sprains commonly so called are in quite a large proportion of cases complicated by slight fractures (pathologically ' unimportant ') ; " again, " a fracture can hardly occur without a sprain at the same time, but a sprain may of course and frequently does occur without a fracture." Eisendrath [4] says: " the recognition of sprain-fractures requires the systematic use of the X-ray in every case of severe sprain."

SPRAIN-FRACTURE AT THE GERMAN HOSPITAL.

In the German Hospital during the year 1910, 89 or 15 per cent. of the fractures confirmed by X-ray were sprain-

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* Read before the Philadelphia Academy of Surgery, October 2, 1911.

fractures. During the first five months of the present year 56 cases of sprain-fracture were diagnosed, being confirmed by X-ray.

The importance of sprain-fracture as attested by its frequency and its location (for being produced most often through the agency of ligaments or tendons it is found at the attachments of these, therefore mostly at or near joints) prompted the writers to study it from a clinical and experimental point of view.

CASES VERIFIED BY X-RAY.

Case 1.—Jan. 20, 1910, W. H. R., age 37. X-ray findings: sprain-fracture lower end radius.

Case 2.—Jan. 24, 1910, Sarah D., age 47. X-ray findings: old sprain-fracture external malleolus.

Case 3.—Jan 26, 1910, Frank S., age 35. X-ray findings: sprain-fracture internal condyle of humerus.

Case 4.—Jan. 28, 1910, Wilh. F., age 63. X-ray findings: old sprain-fracture acromion.

Case 5.—Feb. 10, 1910, Philip O., age 51. X-ray findings: sprain-fracture internal condyle of humerus.

Case 6.—Feb. 14, 1910, John S., age 30, X-ray findings: sprain-fracture internal condyle of femur.

Case 7.—Feb. 16, 1910, Wm. R., age 27. X-ray findings: old sprain-fracture external malleolus.

Case 8.—Mar. 16, 1910, Herb. S., age 19. X-ray findings: sprain-fracture proximal phalanx thumb.

Case 9.—Mar. 19, 1910, Erw. W., age 22. X-ray findings: sprain-fracture internal condyle of humerus.

Case 10.—Apr. 12, 1910, B. McN., age 21. X-ray findings: sprain-fracture lower end tibia.

Case 11.—Apr. 13, 1910, Anna P., age 49. X-ray findings: sprain-fracture internal condyle of humerus.

Case 12.—Apr. 18, 1910, Phil. Pf., age 24. X-ray findings: sprain-fracture fifth metatarsal.

Case 13.—Apr. 22, 1910, Mike M., age 26. X-ray findings: old sprain-fracture internal condyle of humerus.

Case 14.—Apr. 23, 1910, M. Mat., age 45. X-ray findings: sprain-fracture astragalus and cuboid.

Case 15.—Apr. 25, 1910, J. Ha., age 36. X-ray findings: sprain-fracture first metacarpal.

Case 16.—Apr. 25, 1910, Boers., age 35. X-ray findings: sprain-fracture lower end radius.

Case 17.—May 2, 1910, Geo. H., age 49. X-ray findings: old sprain-fracture lower end radius.

Case 18.—May 3, 1910, Fr. O., age 61. X-ray findings: old sprain-fracture external condyle of humerus.

Case 19.—May 6, 1910, Elan. Es., age 57. X-ray findings: old sprain-fracture acromion.

Case 20.—May 7, 1910, Wm. J. W., age 35. X-ray findings: old sprain-fracture scaphoid.

Case 21.—May 7, 1910, Geo. M., age 36. X-ray findings: sprain-fracture radius, fracture styloid process of ulna, impaction scaphoid, semilunar, and radius.

Case 22.—May 9, 1910, Geo. C., age ?. X-ray findings: sprain-fracture external condyle humerus.

Case 23.—May 13, 1910, Roy S., age 17. X-ray findings: sprain-fracture acromion.

Case 24.—May 13, 1910, Fr. S., age 22. X-ray findings: sprain-fracture astragalus.

Case 25.—June 2, 1910, J. Gall, age 36. X-ray findings: sprain-fracture lower end radius, fracture scaphoid and ulnar styloid.

Case 26.—June 2, 1910, McB., age 48. X-ray findings: sprain-fracture upper end of tibia.

Case 27.—June 4, 1910 Dan. R., age 16. X-ray findings: old sprain-fracture upper end of tibia.

Case 28.—June 4, 1910, Lo. Lo., age 42. X-ray findings: sprain-fracture lower end radius.

Case 29.—June 16, 1910, Ed. D., age 21. X-ray findings: sprain-fracture external malleolus.

Case 30.—June 22, 1910, Ash., age 56. X-ray findings: sprain-fracture internal condyle of femur.

Case 31.—June 27, 1910, J. C., age 22. X-ray findings: sprain-fracture external malleolus.

Case 32.—June 28, 1910, M. Mc., age 41. X-ray findings: sprain-fracture external malleolus.

Case 33.—July 12, 1910, Wis., age 24. X-ray findings: sprain-fracture lower end radius.

Case 34.—July 13, 1910, A. H. D., age 50. X-ray findings: sprain-fracture external condyle of humerus.

Case 35.—July 15, 1910, Ma. L., age 55. X-ray findings: old sprain-fracture lower end radius.

Case 36.—July 16, 1910, Fr. G., age 29. X-ray findings: sprain-fracture internal malleolus.

Case 37.—July 22, 1910, Kirs., age 51. X-ray findings: sprain-fracture external condyle of humerus.

Case 38.—July 25, 1910, Wm. B., age 29. X-ray findings: sprain-fracture external malleolus.

Case 39.—July 26, 1910, Ch. M., age 53. X-ray findings: sprain-fracture acromion.

Case 40.—July 26, 1910, J. Th., age 37. X-ray findings: sprain-fracture lower end radius.

Case 41.—July 30, 1910, K. K., age 23. X-ray findings: sprain-fracture upper end tibia.

Case 42.—August 8, 1910, R. McC., age 41. X-ray findings: sprain-fracture external condyle of humerus.

Case 43.—August 18, 1910, D. W., age 25. X-ray findings: sprain-fracture external condyle of humerus.

Case 44.—August 19, 1910, M. McC., age 44. X-ray findings: sprain-fracture external condyle of humerus.

Case 45.—August 31, 1910, H. Ro., age 22. X-ray findings: sprain-fracture external malleolus.

Case 46.—September 8, 1910, R. Oz., age 16. X-ray findings: old sprain-fracture lower end fibula.

Case 47.—September 10, 1910, M. T., age 34. X-ray findings: sprain-fracture first metacarpal.

Case 48.—September 13, 1910, S. M., age 44. X-ray findings: sprain-fracture external malleolus.

Case 49.—September 17, 1910, S. B., age 50. X-ray findings: sprain-fracture acromion.

Case 50.—September 17, 1910, S. Ob., age 52. X-ray findings: sprain-fracture fourth metacarpal.

Case 51.—September 19, 1910, R. G., age 41. X-ray findings: sprain-fracture distal phalanx thumb.

Case 52.—September 19, 1910, E. Long, age 15. X-ray findings: sprain-fracture external malleolus.

Case 53.—September 20, 1910, A. U., age 28. X-ray findings: sprain-fracture external malleolus.

Case 54.—September 23, 1910, E. M., age 26. X-ray findings: sprain-fracture lower end radius.

Case 55.—September 27, 1910, M. K., age 36. X-ray findings: sprain-fracture internal malleolus.

Case 56.—October 7, 1910, J. R., age 20. X-ray findings: sprain-fracture external condyle of humerus.

Case 57.—October 11, 1910, J. Lon., age 13. X-ray findings: sprain-fracture external condyle of humerus.

Case 58.—October 13, 1910, J. B., age 44. X-ray findings: sprain-fracture external malleolus.

Case 59.—October 15, 1910, W. McG., age 44. X-ray findings: sprain-fracture external malleolus.

Case 60.—October 24, 1910, J. H., age 17. X-ray findings: sprain-fracture os calcis.

Case 61.—October 25, 1910, B. S., age 19. X-ray findings: sprain-fracture scaphoid.

Case 62.—October 25, 1910, Fried., age 20. X-ray findings: sprain-fracture external malleolus.

Case 63.—October 28, 1910, Ad. M., age 18. X-ray findings: sprain-fracture external condyle of humerus.

Case 64.—October 29, 1910, G. V., age 17. X-ray findings: old sprain-fracture os calcis.

Case 65.—October 29, 1910, J. C., age 50. X-ray findings: sprain-fracture external condyle of femur.

Case 66.—November 1, 1910, C. B., age 22. X-ray findings: sprain-fracture external malleolus.

Case 67.—November 4, 1910, L. Ab., age 54. X-ray findings: sprain-fracture os calcis.

Case 68.—November 4, 1910, Mike S., age 23. X-ray findings: sprain-fracture internal malleolus.

Case 69.—November 4, 1910, Grif., age 56. X-ray findings: old sprain-fracture head of radius.

Case 70.—November 8, 1910, Gold., age 21. X-ray findings: sprain-fracture external malleolus.

Case 71.—November 9, 1910, Geo. C., age 18. X-ray findings: old sprain-fracture internal tubercle of tibia.

Case 72.—November 10, 1910, P. Cat., age 40. X-ray findings: sprain-fracture internal tubercle of tibia.

Case 73.—November 11, 1910, H. W., age 37. X-ray findings: sprain-fracture astragalus.

Case 74.—November 11, 1910, R. Iz., age 18. X-ray findings: old sprain-fracture external malleolus.

Case 75.—November 12, 1910, Zez., age 30. X-ray findings: old sprain-fracture internal cuneiform.

Case 76.—November 21, 1910, Ch. S., age 39. X-ray findings: old sprain-fracture fourth metacarpal, distal end.

Case 77.—November 22, 1910, M. S., age 52. X-ray findings: sprain-fracture inner tuberosity of tibia.

Case 78.—November 23, 1910, Stu., age 42. X-ray findings: sprain-fracture external condyle of humerus.

Case 79.—November 23, 1910, Ma. M., age 49. X-ray findings: sprain-fracture acromion.

Case 80.—November 26, 1910, E. B., age 50. X-ray findings: sprain-fracture upper end humerus.

Case 81.—November 28, 1910, Wm. S., age 54. X-ray findings: sprain-fracture greater tuberosity humerus.

Case 82.—December 6, 1910, E. S., age 46. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 83.—December 14, 1910, J. D., age 43. X-ray findings: old sprain-fracture cuboid and os calcis.

Case 84.—December 21, 1910, Al. C., age 29. X-ray findings: old sprain-fracture external condyle of femur.

Case 85.—December 22, 1910, J. Lo., age 48. X-ray findings: sprain-fracture internal condyle of humerus.

Case 86.—December 23, 1910, M. D., age 25. X-ray findings: old sprain-fracture external malleolus.

Case 87.—December 27, 1910, Alex. K., age 41. X-ray findings: sprain-fracture both condyles of humerus.

Case 88.—December 27, 1910, J. B., age 51. X-ray findings: sprain-fracture os magnum.

Case 89.—December 28, 1910, Pat. C., age 30. X-ray findings: sprain-fracture external malleolus.

Case 1.—January 5, 1911, N. C., age 18. X-ray findings: old sprain-fracture proximal end metacarpal.

Case 2.—January 16, 1911, S. R., age 14. X-ray findings: sprain-fracture external malleolus.

Case 3.—January 26, 1911, J. J. K., age 60. X-ray findings: sprain-fracture greater tuberosity humerus.

Case 4.—January 30, 1911, Thos. C., age 23. X-ray findings: sprain-fracture head radius, comminuted fracture olecranon.

Case 5.—January 31, 1911, Al. R., age 55. X-ray findings: sprain-fracture acromion.

Case 6.—February 6, 1911, Al. M., age 21. X-ray findings: sprain-fracture lower end radius.

Case 7.—February 6, 1911, Ed. C., age 25. X-ray findings: sprain-fracture lower end radius.

Case 8.—February 7, 1911, Duer, age 42. X-ray findings: sprain-fracture external condyle of humerus.

Case 9.—February 7, 1911, I. G., age 34. X-ray findings: sprain-fracture greater tuberosity humerus.

Case 10.—February 8, 1911, Ch. C., age 30. X-ray findings: sprain-fracture internal condyle of humerus.

Case 11.—February 9, 1911, L. H., age 52. X-ray findings: sprain-fracture olecranon.

Case 12.—February 17, 1911, A. H., age 28. X-ray findings: sprain-fracture astragalus.

Case 13.—February 20, 1911, J. W., age 48. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 14.—February 20, 1911, F. P. M., age 33. X-ray findings: sprain-fracture internal condyle humerus.

Case 15.—February 28, 1911, T. D., age 46. X-ray findings: old sprain-fracture lower end radius.

Case 16.—March 2, 1911, J. C., age ?. X-ray findings: sprain-fracture lower end radius.

Case 17.—March 7, 1911, F. H., age 48. X-ray findings: sprain-fracture lower end radius.

Case 18.—March 8, 1911, L. F., age 23. X-ray findings: sprain-fracture cuneiform.

Case 19.—March 14, 1911, A. B., age 22. X-ray findings: old sprain-fracture external malleolus.

Case 20.—March 14, 1911, S. Br., age 62. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 21.—March 17, 1911, S. H., age 38. X-ray findings: sprain-fracture scaphoid.

Case 22.—March 18, 1911, Ot., age 50. X-ray findings: sprain-fracture greater tuberosity humerus.

Case 23.—March 18, 1911, L. R., age 66. X-ray findings: old sprain-fracture acromion, luxation humerus.

Case 24.—March 18, 1911, C. K., age ?. X-ray findings: sprain-fracture upper end tibia.

Case 25.—March 23, 1911, J. S., age 33. X-ray findings: sprain-fracture external malleolus.

Case 26.—March 23, 1911, M. M. C., age 30. X-ray findings: sprain-fracture post. lip head of radius.

Case 27.—March 25, 1911, Hul., age 35. X-ray findings: sprain-fracture scaphoid.

Case 28.—March 27, 1911, E. A., age 28. X-ray findings: sprain-fracture external malleolus.

Case 29.—March 27, 1911, M. H., age 28. X-ray findings: old sprain-fracture scaphoid.

Case 30.—March 28, 1911, G. W., age 25. X-ray findings: sprain-fracture acromion.

Case 31.—April 8, 1911, F. H., age 41. X-ray findings: sprain-fracture external malleolus.

Case 32.—April 10, 1911, J. G., age 48. X-ray findings: sprain-fracture distal end of third metacarpal.

Case 33.—April 11, 1911, H. M., age 46. X-ray findings: sprain-fracture lower end radius.

Case 34.—April 15, 1911, Pit., age 36. X-ray findings: sprain-fracture outer tuberosity tibia.

Case 35.—April 18, 1911, S. N., age 18. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 36.—April 22, 1911, J. R., age 72. X-ray findings: old sprain-fracture astragalus.

Case 37.—April 22, 1911, J. Mc., age 41. X-ray findings: sprain-fracture cuboid.

Case 38.—April 22, 1911, C. C., age ?. X-ray findings: sprain-fracture acromion.

Case 39.—April 29, 1911, J. C., age 37. X-ray findings: sprain-fracture styloid process of radius.

Case 40.—May 2, 1911, Ed. F., age 50. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 41.—May 4, 1911, M. N., age 50. X-ray findings: sprain-fracture cuneiform.

Case 42.—May 4, 1911, Hug., age 29. X-ray findings: sprain-fracture astragalus.

Case 43.—May 5, 1911, C. McK., age 19. X-ray findings: sprain-fracture external malleolus.

Case 44.—May 6, 1911, E. M., age 52. X-ray findings: old sprain-fracture external malleolus.

Case 45.—May 8, 1911, Koe., age ?. X-ray findings: sprain-fracture os calcis.

Case 46.—May 8, 1911, C. S., age 14. X-ray findings: sprain-fracture fifth metatarsal.

Case 47.—May 8, 1911, J. L., age ?. X-ray findings: sprain-fracture lesser tuberosity humerus.

Case 48.—May 10, 1911, Wm. T., age ? X-ray findings: sprain-fracture astragalus.

Case 49.—May 17, 1911, C. K., age 68. X-ray findings: old sprain-fracture acromion.

Case 50.—May 18, 1911, J. DeL., age 28. X-ray findings: sprain-fracture inner head tibia.

Case 51.—May 19, 1911, R. Gerl., age 40. X-ray findings: sprain-fracture distal phalanx little finger.

Case 52.—May 22, 1911, M. H., age 21. X-ray findings: sprain-fracture scaphoid.

Case 53.—May 26, 1911, M. G. Al., age 24. X-ray findings: sprain-fracture external femur.

Case 54.—May 26, 1911, Ben. G., age 47. X-ray findings: sprain-fracture acromion.

Case 55.—May 31, 1911, C. M., age ? X-ray findings: sprain-fracture lower end radius.

Case 56.—June 1, 1911, A. McD., age 26. X-ray findings: sprain-fracture inner tuberosity tibia.

Of these 145 cases, 46 were in the ankle; 25 the wrist; 25 the elbow; 23 the shoulder; 15 the knee; 9 the hand; and 2 were in the anterior foot region. With the ankle and wrist cases the tarsal and carpal bones have been respectively included. Twenty-eight of the ankle fractures were of the malleoli, and of these 24 were of the external malleolus; being within one of the number of sprain-fractures found at the wrist and over 16 per cent. of this series. Thirty-three of these cases were old (aged three weeks or more). All of these cases suffered as a result of either being treated as a sprain or receiving no treatment.

Most of these cases were caused by indirect violence; a few were caused by direct violence.

As to age, 3 were under fifteen years; 14 were between the ages of fifteen and twenty; 37 between twenty and thirty; 24 between thirty and forty; 30 between forty and fifty; 22 between fifty and sixty; and 7 over sixty. Though there are histological differences in the tissues of adults and children, the same pathology and comparative frequency of sprain-fracture is found in children as in adults.

In the experience of the writers it has been possible to diagnose clinically 77 per cent. of the sprain-fractures shown up by X-ray. Of the remaining 23 per cent., 1 was diagnosed osteoperiostitis, 1 luxation, and the rest sprain, or contusion. In a small percentage of cases that the X-ray did not demonstrate to be sprain-fractures, the diagnosis of sprain-fracture was made. These cases were probably sprain-fractures impossible of demonstration by X-ray.

SYMPTOMS.

There is always a history of application of sufficient force to cause fracture. Pain is seldom very severe. Tenderness, marked and sharply localized over a region of tendinous or ligamentous attachment, is a most important sign. Bone crepitus is very rarely elicited, however joint crepitus is not infrequently present. Preternatural mobility is seldom met with, as these injuries alone are rarely extensive enough to permit of it. Swelling usually occurs and is sharply localized, excepting when synovitis of the joint is present. Deformity is usually present, due most often to swelling at the seat of injury. Ecchymosis, a later sign, is rarely seen. Total disability never occurs and most often there is but little disturbance of function, excepting that disturbance caused by pain.

In old sprain-fractures the tenderness is latent; seldom is it absent. The symptoms of an arthritis are added when actual joint cavities have been involved. Ecchymosis, if originally present, has disappeared at this stage.

EXPERIMENTS IN PRODUCTION OF SPRAIN-FRACTURE.

The following experiments were carried out on dogs, completely anæsthetized with ether, at the Laboratory of Experimental Surgery of the University of Pennsylvania, in order to determine the strength of tendon and ligament as compared with bone. All of the dogs were asphyxiated with gas before recovering from their anæsthesia.

Experiment I.—The skin, ligamentum patella, and all tendon attachments around the left knee-joint were severed. The femur was held in a vice and the leg was grasped with the hand and hyperextended and twisted until the joint was flail-like (subluxated).

Examination showed no gross lesions of the capsule. Further opening of the joint showed the external lateral ligament partly torn from its attachment to the external condyle of the femur; the tear involved the osseous and not the ligamentous tissue (a sprain-fracture). The tear was due evidently to a lateral twist, as it did not occur in the direction of the course of the ligament.

(The above experiment was done after it was found that weight aggregating 160–175 lbs., hung from the tibia, would not make the joint give way.)

Experiment II.—The right thigh was grasped in the left hand and the corresponding leg in the right hand; twisting and hyperextension were done.

Incision and examination showed epiphyseal separation of the head of the tibia, sprain-fracture at the attachment of the patellar ligament to the tibia (the tendon pulling away with it small pieces of bone), and fracture of the crest of the tibia at the epiphyseal junction. No lesions of the knee-joint ligaments, tendons, or bones were found on exposing the joint.

Experiment III.—The left scapula was grasped in the right hand, and the corresponding humerus in the left hand. All motions encountering resistance were persisted in until that resistance was overcome.

Incision and examination showed the shoulder-joint to be undisturbed; but a badly comminuted fracture extending from a short distance beyond the glenoid fossa throughout the rest of the scapula was found.

Experiment IV.—An incision was made over the left knee-joint. The tendon of the quadriceps extensor muscle was cut and freed laterally, grasped in a vice near the tibial end of the patella, and traction was made by the use of weight pulling from the tibia in the normal direction of the tendon.

The patellar ligament separated at the point where the vice grasped it and also broke away from its tibial attachment at one corner, bringing bony tissue with it. Fibrillar tears were noted in the ligament. Failure to have the patellar ligament grasped throughout its breadth may have influenced the results. The vice grip on the ligament no doubt weakened it at this point of pressure.

Experiment V.—The tendon of the semimembranosus muscle was exposed, grasped near its centre in a vice, and traction was made by weights in its natural direction.

The tendon ruptured at the point where it was grasped. No change in its bony attachment was found. In this as in the rest of the cases the vice grip devitalized the tendon at the point at which it was grasped.

Experiment VI.—Same as Experiment IV. Examination showed no rupture of the quadriceps extensor tendon but division of bone at the point of attachment of the tendon. The tendon had pulled the bony tissue to which it was attached away from the tibia.

Experiment VII.—The tendon of origin of the right biceps was exposed and tension was made in its natural direction in the usual way.

Examination showed that the tendon had pulled away the bony cap to which it was attached. The tendon tissue showed no signs of injury.

Experiment VIII.—All skin was removed from the region of the left ankle-joint. All of the tendons passing between points above and below the joint were severed. The tibia was held tightly in a vice. A two-pronged hook was hung from the foot; one prong was hooked around the os calcis, while the other was hooked around the foot over the anterior tarsal bones; weights were hung on the hook.

Fracture of the calcaneum involving the surface articulating with the astragalus resulted. No ligamentous tears were found.

Experiment IX.—Same as Experiment IV. Examination showed no rupture of the patellar ligament but rupture of the bony tissue to which it was attached.

Experiment X.—The tendon of the right tibialis anticus was isolated. Tension was applied in the usual way.

Examination showed no tendon injury but a pulling away of the bone to which the tendon was attached.

Experiment XI.—The skin was removed from the right ankle-joint. The tendo Achillis was cut and the distal end of it was grasped in a vice, weights were added, and a pull was made in the direction which the tendon followed. The foot was held in a vice. Vice No. 1 slipped from the tendon, seemingly isolating three parts. The experiment was repeated on that part of the tendon which was overlapped by the other two parts of the tendon.

Bony tissue of the posterior surface of the calcaneum pulled away with the tendon. This portion of tendon last tested was uninjured.

Experiment XII.—Same as Experiment VIII. The hook slipped from its attachment after some pulling force had been brought to bear.

Examination showed that the anterior band of the external lateral ligament of the ankle had pulled away some bony tissue at its point of attachment to the astragalus. No injury of the ligament occurred.

Experiment XIII.—Same as Experiment V. Examination showed that the semimembranosus tendon had pulled away the bony tissue to which it was attached. The tendon was uninjured.

Experiment XIV.—Same as Experiment IV. Examination showed no injury of the patellar ligament which had pulled away the bone at its point of attachment to the tibia.

Experiment XV.—The left hip was exposed; all of the muscular attachments in this region were cut, leaving the articulation surrounded by its capsule alone. The femur was rotated externally and abducted, producing a luxation.

Examination showed a tear of the weak upper postero-external portion of the capsule and a sprain-fracture at the insertion of the ligamentum teres.

In these fifteen experiments done by using pulling force on tendons and ligaments at some distance from the attachment of them to bone, bone gave away in every test but one. This was the semimembranosus tendon which ruptured where it was gripped by the vice. In another instance besides pulling away some bony tissue the patellar ligament ruptured where it was grasped by the vice. In both cases the ligaments were weakened by the vice grip, and in the latter case the patellar ligament was not grasped throughout its horizontal extent. In a third case showing sprain-fracture at the insertion of the ligamentum teres, luxation of the joint with laceration of the weaker portion of the capsule (that portion of the capsule, the sole function of which is to support the synovial membrane and fluid) was produced. In every other instance (12 out of the 15) bone alone gave way. These experiments show how the frequent occurrence of sprain-fracture is possible, and how rupture of tendon or ligament as a part of the pathology of so-called sprain is impossible.

One striking feature of the experiments was the occurrence of sprain-fracture in the two instances of luxation. The integrity of joints is maintained by strong ligaments, and in order to have a luxation one or more of the strong ligaments must give way; we have shown that ligaments themselves do not give way, but the bony tissue to which they are attached gives way, therefore we think that probably all luxations are permitted by the primary occurrence of a sprain-fracture.

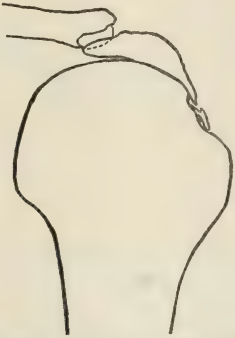
Upon this subject the writers expect to have more to say in the future.

DIAGNOSIS.

The X-ray of course makes diagnosis conclusive when sprain-fracture is demonstrated. Through the courtesy of Dr. A. G. Miller (Skiagrapher to the German Hospital) the writers have been able to make schematic representations of some of his plates (Figs. 1 and 2, 1911, show sprain-fractures easy of demonstration). However, a negative X-ray in the presence of suggestive clinical signs should not exclude the possibility of sprain-fracture, chiefly for three reasons: first, experience and skill are required in the making and interpretation of X-ray plates (Figs. 3 and 4, 1911, and 5, show conditions such as one of little experience might find it difficult to diagnose); second, the X-ray picture if not taken in the proper plane may not show a really quite distinct sprain-fracture (Figs. 6 and 7 represent plates from cases of sprain-fracture that showed no signs of sprain-fracture in plates taken in other planes); third, some sprain-fractures are so slight as to escape the detection of the most capable skiagrapher (Fig. 4, 1911, may be again referred to as one approaching that class).

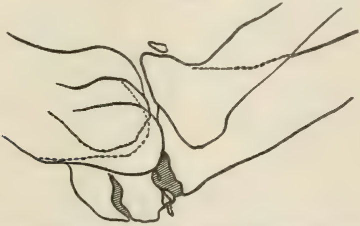
Clinically, history of sufficient injury with a small, sharply localized area of swelling and acute tenderness over a region of tendinous or ligamentous attachment is diagnostic of sprain-fracture, and should be considered as such whether or not X-ray verifies the diagnosis. Tenderness of lesser degree may surround an acutely tender area. Tenderness lasts as a rule from five to twenty days, longer in improperly treated cases; however, those few cases with symptoms as given above, in which tenderness disappears within forty-eight hours, are nevertheless sprain-fractures. The acute tenderness which

FIG. 1.



Sprain-fracture of greater tuberosity of humerus.

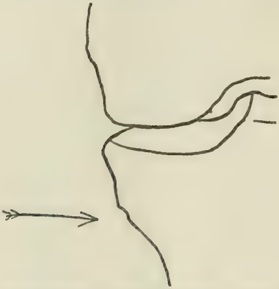
FIG. 2.



Sprain-fracture of head of radius; fracture of olecranon process of ulna.

we have referred to is unmistakable; when the spot is firmly pressed on the patient invariably winces.

FIG. 3.

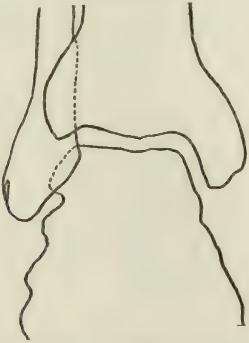


Sprain-fracture of outer tuberosity of tibia.

DIFFERENTIAL DIAGNOSIS.

Tenderness and swelling or both, not sharply localized, with the tenderness not so acute (not causing wincing on firm pressure) are occasionally found in joint regions. These symptoms have four causes: the first is contusion, resulting from direct injury; the second is strain, the placing of tension on tendons, ligaments, or other soft parts (nerve injury cannot be confused with sprain-fracture, as symptoms rela-

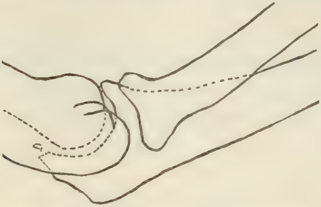
FIG. 4.



Sprain-fracture of external malleolus of fibula.

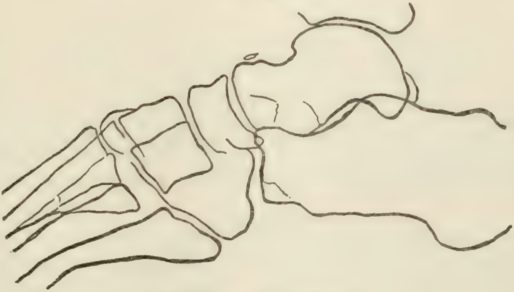
tive to its origin and distribution are associated); the third is rupture of diseased tendons or ligaments (a very rare occurrence that can be considered only as a complication of disease); the fourth is a luxation that has reduced itself. Bennett gives the old definition of sprain as "a wrench or strain resulting in stretching or laceration of the soft parts without external wound." The writers have proven that laceration of soft parts does not occur; where laceration occurs we have a sprain-fracture. The simpler term strain we have already given to the result of the placing of tension on soft parts. The word sprain, standing alone, we eliminate; but using it with fracture the condition formerly looked upon as severe sprain is described. Self-reduced dislocations show in many instances rupture of the weaker portion of the capsule. As intimated before, a more careful search for such a condi-

FIG. 5.



Sprain-fracture of olecranon process of ulna.

FIG. 6.



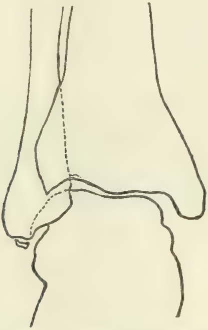
Sprain-fracture of astragalus.

tion may reveal the presence of a sprain-fracture in luxations, it being of course at a different seat from the tear of the capsule.

A painful swollen joint, generally tender, with no history of injury and a negative X-ray, if you like, speaks for acute arthritis; a similar history, less marked, speaks for chronic arthritis.

A fairly large, tender, indefinite swelling following direct injury, and most likely not seated at a point of tendinous or ligamentous attachment, points to osteoperiostitis. X-ray findings make differentiation more easy.

FIG. 7.



Sprain-fracture of external malleolus of fibula.

TREATMENT.

The seat of fracture together with the joint nearest the fracture should be immobilized. When carpal or tarsal bones are involved, the wrist- or ankle-joint should be immobilized with the smaller joints. Plaster of Paris serves this purpose best in the upper as well as the lower extremity, and rest of the body, for absolute rest is essential. Casts should be used for three weeks; at the end of this time, moderate motion may be started. Massage should be begun at the end of ten days. In an uncomplicated case, fairly free use of the injured tissues can be allowed at the end of the sixth week. This treatment is arbitrary, and must of course be influenced by the individual case. General relaxation of joints may follow as a result of treatment, if care is not taken to avoid muscular atrophy. Proper treatment gives excellent results which are permanent.

Lack of treatment and treatment as sprain (drug-store treatment) provide many cases of chronic arthritis, deformity, persistent pain, and weakness; excessive callus formation is a common result; non-union, permitting the free bony tissue to catch between joint surfaces, can occur.

CONCLUSIONS.

1. History of sufficient injury, with a sharply localized area of swelling and acute tenderness over a region of ligamentous or tendinous attachment, means sprain-fracture.
2. X-ray is not essential for the recognition of sprain-fracture.
3. The external malleolus is probably the most frequent seat of sprain-fracture.
4. About 15 per cent. of all fractures are sprain-fractures.
5. That condition, formerly called severe sprain, is sprain-fracture.
6. The condition resulting from stretching of soft parts is better termed strain.
7. Sprain-fracture is probably a part of the pathology of every dislocation.
8. If in doubt as to whether or not sprain-fracture has occurred, treat as sprain-fracture.

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A DRESSING FOR FRACTURE OF THE CLAVICLE.*

BY HOWARD D. COLLINS, M.D.,
OF NEW YORK,
Surgeon to the City and J. Hood Wright Memorial Hospitals.

It is almost impossible to maintain an accurate reduction of the fragments following a fracture of the clavicle by means of the ordinary fixation dressings. Accordingly, to obtain perfect results, surgeons in these days resort to some form of spiking or suture. Nevertheless, unless the deformity be very great, the future utility of the arm is so little impaired that we are content with a faulty union that would not satisfy us in other parts of the body. Hence one is frequently justified in resorting to a fixation dressing although knowing that a more radical treatment would give more æsthetic results.

Of all the dressings in vogue, the Sayre dressing offers the best theoretical lines of force toward maintaining the reduction, and, yet, this dressing has so many disadvantages that the writer was prompted to invent something to eradicate, as far as he could, these defects.

The ordinary Sayre dressing consists of a strip of zinc oxide adhesive plaster four or five inches wide, one end of which is passed as high as possible about the arm over the biceps of the injured side so as to form a loop around the humerus; the other end is passed across the back around the other axilla and across the front of the chest as far or further than the median line in front. The loop around the humerus is left fairly loose so as not to constrict the arm, and the long end is drawn on as firmly as possible, when made to adhere to the chest. The object of the strip is to draw the shoulder as far back as possible. A second strip about three inches wide is passed under the elbow, one end extending up across the front of the chest, the other up over the back to meet on top of the healthy shoulder. The object of this second piece is to raise the injured shoulder and support the elbow.

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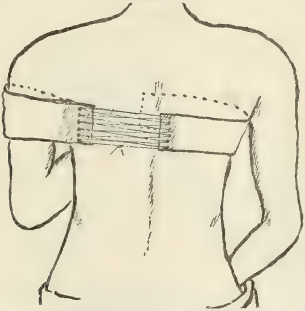
* Demonstrated before the meeting of the New York Surgical Society, Nov. 8, 1911.

The lines of force exerted by this dressing are just those desired, but the objections to the dressing are as follows:

1. The zn. oxide plaster becomes in a few days an irritant, especially in stout people.

2. After a day or two, as the body becomes adjusted to the dressing, the full force of the traction is lost, so that the reduction is no longer maintained. This necessitates the renewal of the dressing, and those of us who have removed zn. oxide adhesive plaster two or three times and reapplied fresh plaster are only too familiar with the painful and dangerously excoriated surface of the skin produced.

FIG. 1.



Posterior view, showing arm loop and body piece. Shaded area of bandage outlines portion reduplicated or lined, so that no adhesive surface is presented to the skin at those points.

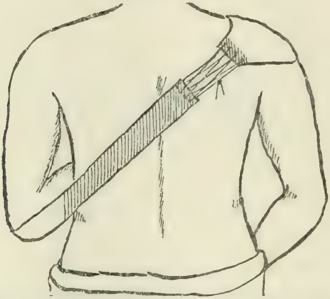
It is to meet these objections the following dressing was devised:

The material used consists of heavy moleskin adhesive plaster, which, while more troublesome to apply and taking longer to become firmly adherent to the skin, is non-irritating.

The lines of force are the same as those of the Sayre dressing and are applied as follows:

First, a piece of moleskin four or five inches wide is passed about the humerus as high up in the axilla as possible, and the ends, for about two inches of their length, caused to adhere to each other. This piece should be for the average about eighteen inches long. Before applying, the whole strip should be warmed so as to cause it to adhere to the circumference of the arm. At the posterior end of this loop, *i.e.*, where the ends are adherent to each other, six holes are punched and eyelets inserted (these eyelets are similar to those through which the laces of shoes are passed and are made with a little hand punch devised for the purpose). A second strip of moleskin, the same width as the first, is passed about the body, extending from the midline behind around the chest on the healthy side as far or even across the midline in front. The posterior end of this strip is turned over on itself for about two inches and a similar row of eyelets inserted. The two rows of eyelets should be about six inches apart and then an ordinary corset lace put in. With this lace the ends are drawn together with the result that the shoulder can be pulled back as far as desired.

Fig. 2.

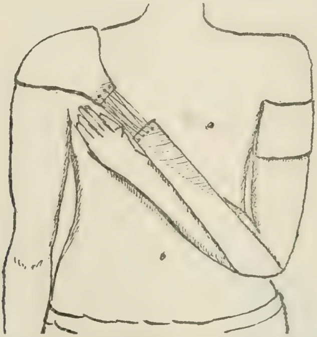


Posterior view, showing shoulder cap and elbow sling.

The second part of the dressing is applied as follows:

A broad piece of moleskin about seven inches wide and a foot long is applied over the healthy shoulder in the form of a cap extending well down on the arm. (In order to secure a cap-like structure, it is necessary to cut a "dart" in the moleskin.) The free ends are turned back on themselves and cut to a taper, so that the margin is not more than three inches wide. A row of four eyelets is placed in each end. The last piece of the dressing consists of a long strip of moleskin three inches wide, passed around the forearm of the injured side close to the elbow, one end extending up the front of the chest, the other up the back. The ends of this strip are also turned back on themselves and each has a row of four eyelets. This strip should be lined with muslin so that there is no adhesive surface exposed except where the moleskin is in contact with the forearm and elbow. A lacing joins this elbow piece with the shoulder cap in front and another is placed behind. The front and back lacings between the elbow sling and shoulder cap permit the injured shoulder to be raised or, by tightening one lacing more than the other, the elbow may be brought forward or back as desired.

Fig. 3.



Anterior view, showing shoulder cap and elbow sling.

In applying this dressing, it should be borne in mind that the pieces should be carefully cut and fitted before the adhesive surface is warmed, and also that the laces should not be tightened before the adhesive has become thoroughly secured to the skin.

The only disadvantage of this apparatus is the length of time required for its application. This disadvantage is more than offset by the advantages, which are: (1) a non-irritating dressing that may be worn three or four weeks; and (2) the chance to tighten the lines of traction as occasion may require without removing the adhesive.

FRACTURE OF THE FLOOR OF THE ACETABULUM.*

WITH FOUR ILLUSTRATIVE CASES.

BY PENN G. SKILLERN, JR., M.D.,

AND

HENRY K. PANCOAST, M.D.,

OF PHILADELPHIA.

In dealing with this subject of fracture of the floor of the acetabulum, we shall first present four cases observed by us, then consider the cases hitherto reported in the literature, and finally discuss the subject in general.

Case I.—G. B., male, age forty-three, coachman, admitted June 7, 1911. Fell eighteen months previous to admission a distance of eighteen feet to pavement, landing on right side on greater trochanter of femur. He was laid up for three months in the British Hospital in Hongkong, where he was treated by massage. Since then he has had a limp, which has been getting worse, as well as pain confined to upper anterior part of right thigh. Examination revealed slight atrophy of muscles in right gluteofemoral region when compared with those of the left side, with motion slightly painful and limited in all directions, but particularly in abduction. Mensuration from internal malleolus to anterior superior spine 33 inches on both sides. The base of Bryant's triangle was equal on both sides; the greater trochanter did not rise above the Roser-Nélaton line on either side; and two lines drawn, one between the anterior superior spines and the other between the tips of the greater trochanters, were parallel. Therefore, there was no demonstrable shortening. Measurements from middle of symphysis pubis to greater trochanters equal on both sides. Therefore, there was no inward displacement of greater trochanter. Rectal examination revealed inward bulging of floor of acetabulum on injured side, but none on opposite side. The skiagram, a diagrammatic sketch of which is shown in Fig. 1, showed inward, tent-like bulging of the middle of the floor of the acetabulum, in keeping with the rectal findings on palpation. In view of the age of the injury (18 months)

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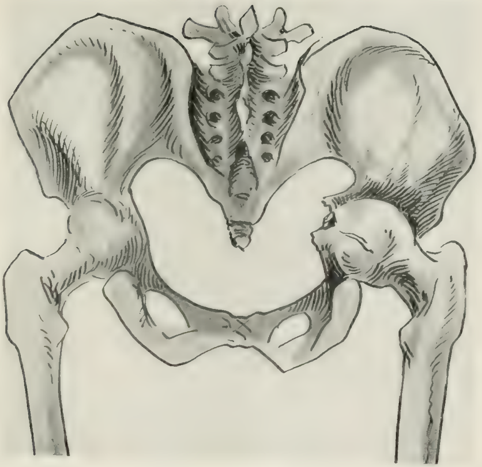
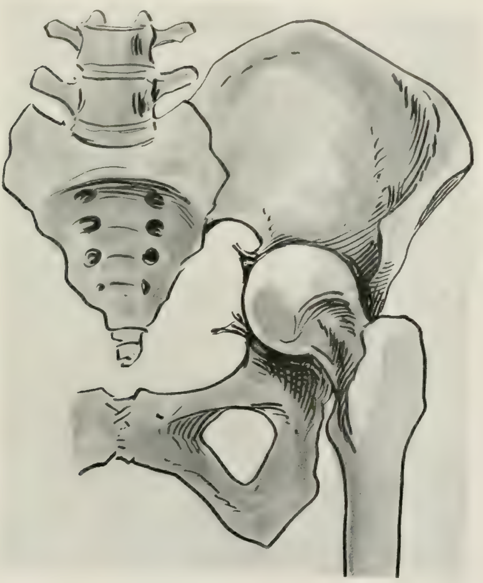
* Read before the Philadelphia Academy of Surgery, October 2, 1911.

FIG. 1.



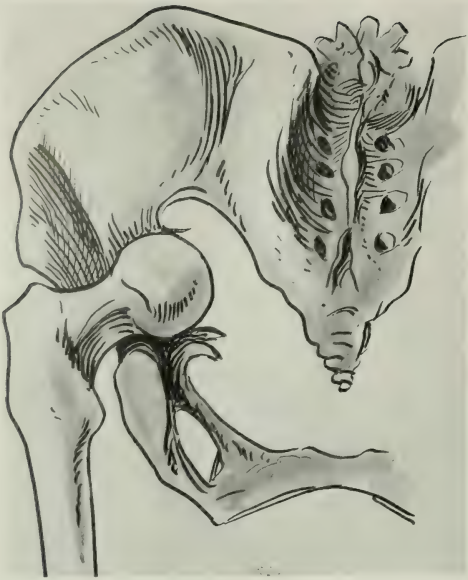
Fractura acetabuli perforans. Note stoving-in of floor of acetabulum, right side. Approximation of greater trochanter to ilium. Posterior view. Sketch from Röntgen plate. (Case I.)

FIG. 2.



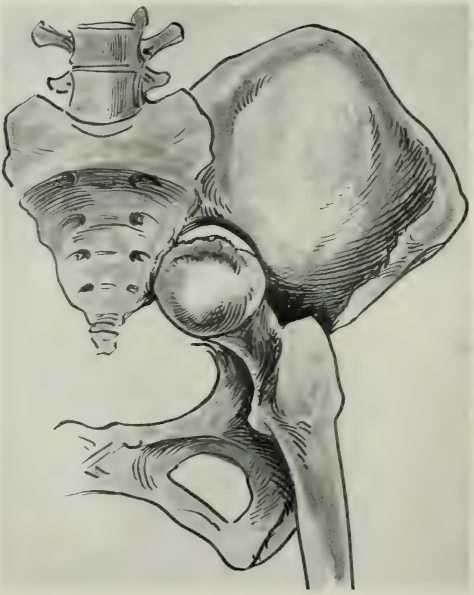
Fractura acetabuli perforata. Note head displaced into pelvic cavity. Juxtaposition of greater trochanter and ilium. Left side, anterior view. Sketch from Röntgen plate. (Case III.)

Fig. 3.



Fractura acetabuli perforata. Note head displaced into pelvic cavity. Juxtaposition of greater trochanter and ilium. Left side, posterior view. Sketch from Röntgen plate. (Case III.)

Fig. 4.



Fractura acetabuli perforata. Note head in contact with sacrum and entrance of greater trochanter into pelvic cavity. Left side, anterior view. Sketch from Röntgen plate. (Case IV.)

and the trifling degree of damage to the pelvis, no measures were indicated other than massage and passive motions, which were employed with some benefit until the patient left town.

Case II.—J. K., male, age fifty-three, plasterer, admitted October 9, 1911, to service of Dr. John B. Deaver. He had fallen from a height of 20 feet, to the ground, from a scaffold upon which he had been working, striking on the left buttock. Thereafter he could not move, and was admitted to the hospital complaining of disability and pain in hips.

He was immediately catheterized, and ten ounces of clear urine were withdrawn. Further examination revealed a large contusion with ecchymosis upon the left buttock. Pressure upon the pelvis from side to side gave sharp pain in right groin. No crepitus; no dulness in flanks. Rectal examination revealed slight bulging inward of left pelvic wall.

Skiagram showed (1) inward depression of floor of acetabulum (fractura acetabuli perforans) left side, quite identical with the damage shown in Fig. 1; (2) fracture of pubis, horizontal ramus, right side. This lesion was about an inch from the symphysis, and probably resulted from "contre coup." It accounted for the sharp pain in the right groin referred to above.

Case III.—G. S., male, age thirty-one, admitted January 5, 1904. Fell on left hip 2½ years previous to admission. Complete history not obtainable. Skiagram shows fracture of floor of left acetabulum with head of femur displaced into pelvic cavity (Figs. 2 and 3).

Case IV.—M. P., male, age thirty-one, admitted December 2, 1910. Fell on left hip 11 months previous to admission. Complete history not obtainable. Skiagram revealed fracture of floor of left acetabulum with displacement of femoral head into pelvic cavity (Fig. 4). This skiagram gives the impression that the femoral head is in contact with the sacrum, in which case there must be in addition either a fracture of the tip of the greater trochanter or else of the upper margin of the acetabulum.

The first recorded case of this injury was rather vaguely described by Henry Callisen in 1788 (*Principia systematis. Chirurgiæ hodiernæ*, 1788). Up to 1904 Arregger (*Deutsch. Zeitschr. f. Chirurg.*, 1904, lxxi, 487) collected 23 cases, including one of his own. In 1909 Schroeder (*Quart. Bull. of Northwest. Univ. Med. School,* 1909, xi, 1, p. 9) collected 49 cases, including three of his own. Somewhat later in 1909 A. E. Halstead added two cases, one his own, bringing the number up to 51. Our four patients make a total of 55 cases reported over a period of 123 years, thus emphasizing the relative rarity of this injury.

Nomenclature.—The Germans refer to this injury as central luxation of the femur (Zentrale Luxation des Schenkelkopfes), thus giving but secondary consideration to the fracture of the acetabulum. Analogous to this is the so-called central dislocation of the jaw, in which the condyle of the mandible is driven through the glenoid fossa at the base of the skull. English authors usually write under the title "Fracture of Acetabulum with Displacement of Head of Femur into Pelvic Cavity" or "Perforation of the Acetabulum by the Head of the Femur." None of these terms appears to us to be sufficiently comprehensive. In the first instance a moment's thought is convincing that we are not dealing with a dislocation in the accepted sense of the term. Holmes defines a traumatic dislocation as "a forcible separation of the articular surfaces of two or more bones, effected by the rupture or stretching of their ligaments." In our injury the floor of the acetabulum is not necessarily separated from the femoral head, and, furthermore, the capsule of the joint is neither torn nor stretched, but, on the contrary, it is made lax and telescoped on itself. Therefore, we have to deal with a displacement, rather than with a dislocation. Again, the injury varies from a slight depression of the floor of the acetabulum, as in Case I, to the passage of the femoral head into the pelvic cavity, as in Cases III and IV. After all, the extent of injury is only a question of the degree of the vulnerating force plus the strength of the bone. For the injury illustrated by our Case I we suggest the term "fractura acetabuli perforans," which implies that the head of the femur started to perforate the acetabular floor but that the vulnerating force expired before the act was completed. For cases where the head of the femur is displaced into the pelvis, we suggest the term "fractura acetabuli perforata," which implies completion of the act and therefore the presence of the displaced head in the pelvic cavity. We believe with the Germans that Latin terminology is not only more exact but also far more expressive.

Etiology.—With but one exception the cause of this injury was indirect violence, most of the patients having fallen a considerable height and landed on the ground upon the greater trochanter. Others have been struck upon the greater trochanter by a heavy object.

Mechanism.—In falls from a height the acetabulum is passively broken, just as a loose hammer-head is forced upon its handle by pounding the latter upon the floor. When struck by a heavy object, on the contrary, the acetabulum is actively broken by the wedge-like action of the femoral head. The question naturally arises in your minds, when, given a certain vulnerating force, does the acetabulum yield to fracture and when the neck of the femur? While it is difficult to answer, yet several theories suggest themselves. In the first instance, in these injuries the femur has usually been slightly adducted, the force acting upon the greater trochanter in the continuation of the long axis of the femoral neck and head. The cancellous tissue in the head and neck of the femur is arranged as pressure and tension lamellæ, which spring from the inner and outer walls so as to form Gothic arches. It seems plausible, therefore, that these arches would yield least to force applied in the direction of the long axis of the head and neck, so that the force would expend itself upon the pelvis. In our injury the floor of the acetabulum, notoriously a weak place because of its thinness in all ages and of the meeting here in childhood of its three constituent bones, now fractures more or less extensively. If the force strikes the neck of the femur aslant these Gothic arches, however, fracture of the neck may sooner ensue. Variations in the angle of the neck with the shaft, in forward inclination of the neck, as well as in the index of the neck may also act as determining factors in the fracture of one or other bone. But few of the patients were superannuated, and therefore but few of the femoral necks were weakened by the osteoporosis incident to senescence. From this we might conclude that when the neck of the femur is healthy and squarely set, so to speak, it withstands this particular force more stoutly than the floor of the acetabulum. Examination of the macerated innominate bone shows that the non-articular part of the acetabulum is thin enough to transmit light. The area in relation with the articular part of the acetabulum forms an apparently strong and stout buttress, but the thickness here consists solely in two thin shells of compact tissue between which is sandwiched a large amount of fragile cancellous tissue. Thus it is probable that many of the fractures of the acetabulum are of the variety known as "compression-fractures." As in the skull, the inner shell of compact bone would fracture more extensively than the outer. After removal of the acetabulum, it will be found that the head of the femur can penetrate into the pelvic cavity only about 3 cm., when the greater trochanter impinges upon the ilium. Fracture of the tip of the greater trochanter, however, or of the ilium would permit the head to extend further into the pelvis.

Symptoms.—The symptoms vary naturally according to whether the fracture is perforating or has perforated. The subjective symptoms are pain on motion, localized tenderness, and disability, plus those of whatever complications may exist. Given a macerated pelvis, the objective signs and complications are as easy to read as the handwriting upon the wall. There will be more or less approximation of the trochanter to the symphysis pubis along Morris's line and rectal or vaginal palpation of the stove-in acetabular floor or displaced femoral head. These two signs in conjunction with a good skiagram suffice for diagnosis. There are other signs less distinctive because common to other injuries in this region.

Differential Diagnosis.—In our opinion the most important differential diagnosis is from contusion of the hip. Far more lives will be saved by the correct diagnosis of contusion of the hip than will be lost by overlooking a more patent injury, such as Malgaigne's double vertical fracture of the ilium behind and the pubis and ischium before. The diagnosis of contusion of the hip is really very creditable when correct, for it very properly implies deductions based upon a most careful and painstaking process of exclusion.

Complications.—The complications of this injury but reflect the regional anatomy of the pelvis, and depend upon the extent of the fracture and the shape and character of the fragments. Hæmatomata formed very frequently in the reported cases, due to laceration by a sharp fragment either of small vessels or of large ones, even the external iliac vein. If the peritoneum is likewise torn, the blood enters the peritoneal cavity as free fluid, instead of forming an extensive retroperitoneal hæmatoma. The obturator nerve, situated in the path of the fragments, is apt to be bruised, lacerated, or severed. Laceration of bowel or bladder is quite within the realms of possibility. The urethra ordinarily escapes because remote, while to reach the ureter a fragment must pass through the thick iliopsoas. The frequency of complications will be lowered in direct proportion to the care and gentleness with which the examination is conducted.

Prognosis.—In the absence of complications the prognosis is good. Stiffness, lameness, and disability of the hip-joint are liable to persist temporarily.

Treatment.—Given a patient with a fresh injury to the hip, we would ignore absolutely any academic paring of the diagnosis until we had satisfied ourselves that the bladder was not ruptured, that the intestines had not been harmed, and that no dangerous hemorrhage was in progress. Now with conscience free to act we would reduce the fracture, put the patient at rest in bed, and apply extension in the axis of the limb in conjunction with lateral traction upon the femoral neck. After a few days, if all goes well, we would apply a gypsum case from the roots of the toes to the costal margin. Having obtained satisfactory union, we would combat the effects of prolonged immobilization of the hip-joint by massage and judicious passive motion.

For the privilege of reporting these cases we are indebted to Drs. J. William White, John B. Deaver, Charles H. Frazier, and B. A. Thomas, in whose services at the University Hospital they occurred.

CLAMP FOR LINING UP FRACTURED LONG BONES.

BY WILLARD BARTLETT, M.D.,
OF ST. LOUIS, MO.

Dr. Richard H. Harte, in his Presidential address before the American Surgical Association, in June of this year, felt it sufficiently important to discuss the care of fractures of the long bones. Among his many excellent remarks regarding operations of the kind under consideration here, he said:

> "These operations are often most difficult, requiring a special type of instruments and a thorough surgical technic (which is not in the province of every man who considers himself a surgeon), and the wounds are more prone than any other class of wounds to infection, and the risk to life and limb is thereby proportionately increased."

Since this question has been brought to the attention of surgeons, there has been a revival of interest in the treatment of fractures, especially in that most modern method of operative treatment, the use of the Lane bone plate.

The perfection of the mechanical devices and instruments for use in the Lane plate operation is so important that various eminent surgeons, having experienced this need, have offered a number of excellent suggestions. Dr. Edward Martin, of Philadelphia, presented an elaborate outfit of instruments for such use, at the Denver meeting above mentioned.

Any surgeon who has had personal experience in the use of Lane's bone plates, appreciates that, in the treatment of recent fractures, no open operation is justified unless ideal approximation is to be obtained. This means that all the fragments must dove-tail perfectly.

Great difficulty is generally experienced in perfectly lining up two main portions of a broken long bone. A few millimetres tend almost invariably to prevent the axes of both from coinciding. In addition to this is the very important

FIG. 1.

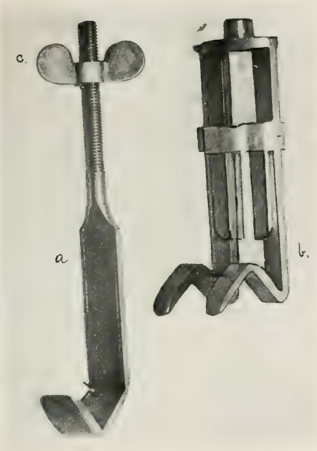


FIG. 2.

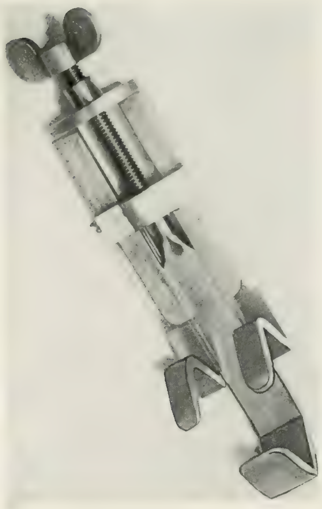
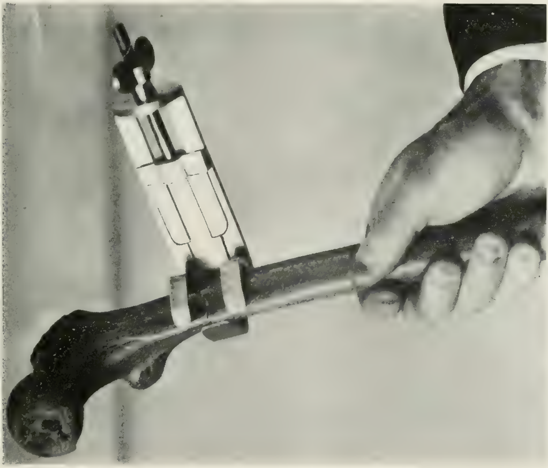


FIG. 1.—Shows three parts of instrument. (*a*) male blade; (*b*) female blade; (*c*) butterfly screw.
FIG. 2.—Showing front view of clamp.

FIG. 3.



Shows the clamp in position grasping bone.

consideration of the unequal rotation in the two parts of the bone, which goes far in preventing an ideal approximation. These, of course, are largely mechanical difficulties which require a mechanical solution.

The instrument under consideration in this paper is designed to meet this need. In a previous article which was published in the *Journal of the American Medical Association,* Oct. 21, 1911, vol. lvii, pp. 1347-1351, entitled "Experimental and Clinical Work to Determine the Value of Lane's Bone Plating," is described an embracing instrument. This appliance was originally intended for the purpose indicated in that article. It is, however, a step in the development of the instrument herein discussed.

The three accompanying illustrations give a clearer idea of the clamp than any description in words could possibly do.

Fig. 1 shows the three separate parts of the instrument. (*a*) The male blade of the clamp. (*b*) The female blade. This slips down easily over the threads of the screw part of the male blade; it rests on the upper surface of the bone, and opposes the male blade which tends to support the fracture from beneath. (*c*) The butter-fly screw, used for securing clamp in position, and for regulating the exact and necessary force required.

Fig. 2 shows the various parts of the clamp in general position, when in use.

Fig. 3 shows the clamp in position grasping bone. It will be noticed that the fracture appears on the upper surface, and in plain view.

Following is the technic for using this clamp on the femur: First procedure: As soon as the bone ends are exposed, all blood-clots, early granulations, or tissue fragments should be carefully picked out of the fracture planes with a pointed instrument or brush. Second: Over-traction is then exerted on the foot until one centimetre space exists between the ends of the fragments. Third: One or the other fragment is then rotated until the bony ridges or the corresponding fragments show that the bone is in proper position, or as nearly correct as the eye can judge. Fourth: While in this position, the long or male blade of the clamp can be easily slipped down under the fracture line. Then as quickly as possible, the female or upper half of the instrument should be superimposed. Screw the butter-fly nut down tight. This brings the opposing right-angled planes toward one another. Thus the fragments of the bone are brought into line. Fifth: When the correct position of the bone is thus well secured by the clamp, the traction on the broken member may then be released. The muscle tension, aided by a blow on the heel, dovetails all the fragments. It may be necessary to slightly loosen the clamp for this purpose. Sixth: The clamp is now loosened sufficiently to receive the bone plate, which is inserted in the right angle of the upper lips of the clamp, after which the nut is screwed down hard. Care should be taken that the plate is well suited in size to the fracture, and that the screw holes, or at least a sufficient number, fall on sufficiently strong bone tissue. Seventh: The drilling and screw driving may now be accomplished without any of the labor ordinarily incident to keeping the fragments in more or less accurate approximation. Should the clamp cover a screw hole, as it often does, a screw can be put in on either side of the fracture, the clamp shifted, and other screws then secured.

There are a number of advantages which especially characterize this instrument.

(1) It is open above, so that the fracture line may be seen at all times.

(2) It holds the plate firmly on the bone, and supports the whole while the screws are being driven.

(3) It is easy to place in position, since each half is applied or removed separately.

(4) It consists of four inclined planes so disposed that fragments of any shape or size are driven to a common axial centre.

FRACTURE OF THE SESAMOID BONES.*

BY GEORGE P. MÜLLER, M.D.,
OF PHILADELPHIA.
Associate in Surgery in the University of Pennsylvania; Surgeon to St. Agnes Hospital.

It is of course common knowledge that the patella is a sesamoid bone and that it is frequently fractured. There does not exist, however, a definite understanding of the fact that the other sesamoid bones may also be fractured; in none of the standard systems or text-books of surgery, nor in the monographs on fractures is there any mention of this condition.

The sesamoid bones are so named from their resemblance in size and shape to the grain sesamum. They are constantly present in the thumb and great toe. In 1892 Pfitzner [1] from an examination of macerated preparations—388 of the hand and 385 of the foot—found that sesamoid bones were present on the ulnar side of the fifth finger in 82.5 per cent., on the radial side of the index-finger in 48.7 per cent., and occasionally on the radial side of the third and fifth fingers. Fawcett [2] in 1897 made the first X-ray study of these bones and found sesamoids in the little finger in 71 per cent. and in the index-finger in 55.2 per cent., in an examination of 38 pairs of hands. Pfitzner found a sesamoid at the interphalangeal joint of the thumb in 69.3 per cent. and Fawcett in 68.5 per cent.

In the feet the sesamoids were found by Pfitzner to occur on the fibular side of the fifth toe in 6.2 per cent., on the tibial side of the fifth in 5.5 per cent., and on the tibial side of the second in 1.8 per cent. of times.

In 1904 Stieda [3] observed two sesamoid bones on the plantar aspect of the interphalangeal joint of the great toe, a tibial sesamoid of the fourth toe and an X-ray showing

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* Read before the Philadelphia Academy of Surgery, October 2, 1911.

9 sesamoids in the five fingers of the hand. He also made the important observation, later confirmed by Dwight,[4] that there might exist an anomalous division of the sesamoid into two parts, a condition easily mistaken for fracture. In 1907 Momburg[5] reported the instances of two soldiers who injured their feet while jumping from a springing board. The area of tenderness and the X-ray led to a diagnosis of fracture of the sesamoid, but upon X-ray examination of the well feet a similar division of the sesamoid was found. Momburg also records that an examination of his X-ray records reveals 9 instances of a division of the tibial sesamoid, in 3 the bone was in 3 pieces and in 1 in 4 pieces. In 6 the division occurred in both feet. In a second paper Stieda[6] pictures the rare interphalangeal sesamoid of the index-finger, a third or accessory sesamoid at the metacarpophalangeal joint of the great toe and a curious instance of a sesamoid at the web between the great and second toes.

In 1904 Wolff[7] reported 3 instances of a sesamoid in the tendon of the gastrocnemius; in 1909 Pancoast[8] wrote a complete paper on this sesamoid and stated that in about 12.5 per cent. of persons there is a sesamoid in the tendon of the outer head of the gastrocnemius. He calls attention to the possibility of mistaking it for a loose or foreign body in the popliteal bursa.

Dwight notes the frequent occurrence of an isolated bone in the tendon of the tibialis posticus; he terms it the *tibiale externum,* a true part of the skeleton, being found in many mammals and being cartilaginous in the second month of the embryo. In 10 per cent. of persons it is a separate bone; in the remainder it is part of the tuberosity of the scaphoid. Painter[9] reports a sprain-fracture of the tibialis posticus tendon in which operation revealed the isolated bone, the size of a lima bean, seeming to have a false joint between it and the body of the scaphoid.

The sesamoid bones are developed from cartilage and first make their appearance as osseous structures in the toe about the eleventh year, the others a year or two later. They are usually met with in the substance of tendons and in the neighborhood of joints. One surface is usually covered with cartilage and either enters into the formation of the joint or, separated from it by a bursa, plays on another bone, or on cartilage or ligament. This function is to obviate friction or to change the direction or pull of a muscle. They are to be considered as parts of the skeleton all of which have their places in certain animals, but all of which either are not developed, or if they do appear are again lost in others. Thus, certain sesamoid bones of the finger are frequent in the fœtus and rare in the adult (Piersol). The feet of the armadillo and the forefeet of the mole are provided with many sesamoids; in the horse one of the sesamoids is termed the navicular.

The constant sesamoids of the thumb are two in number, situated on either side of the middle line at the metacarpophalangeal joint. They are connected by a strong fibrous band which forms the floor of the groove for the long flexor tendon. Anteriorly they give attachment to the short muscles of the thumb, and posteriorly are smooth. The lateral ligaments of the joint are partly inserted into their sides.

Fracture of these sesamoids seems to have been observed but twice. In 1907 Preiser[10] reported the instance of a woman, 30 years of age, who fell on the right hand and broke both of the sesamoids of the thumb, and in 1909 Morian[11] observed a fracture of the ulnar sesamoids in a girl age 27, who had caught the thumb in a closing door.

The constant sesamoids of the great toe are developed in the tendon of the flexor brevis hallucis and play in a groove on the head of the metatarsal. They are united to both phalanx and metatarsal by stout fibres and laterally are connected with the lateral ligaments of the joint and the sheath of the flexor tendons.

The first instance of fracture of these bones was reported by Schunke[12] in 1901; Marx,[13] Muskat,[14] Momburg,[5] Igelstein,[15] Stumme,[16] Morian,[11] and Painter[9] have also reported cases. Of the 16 cases reported, including my own, 14 were in males, one in a female and one not stated; the ages ranged from 14 to 66 and averaged 37 in twelve where the age was given. Nine occurred in the right foot, 6 in the left. The external or fibular sesamoid was fractured in 1 case, the tibial sesamoid in 9 and in 5 there was a division in the sesamoids of both toes although only one side had been injured. On account of the finding of a division on both sides Momburg doubts the authenticity of the fractures he reports and both Igelstein and Painter are inclined to do likewise of theirs. That fracture is possible has been proven by the pieces excised and by the experiments of Stumme on the cadaver. He proved that forcible dorsiflexion with abduction may fracture the tibial sesamoid. He also believes that we can differentiate a fracture from an anomalous division: by the sharp edge of the line of fracture, by the oval shape of the fragments in the anomalous division, by the history of the case and a normal other toe. The character of injury in the reported cases is variously given as being due to sudden falls on the feet and the dropping of heavy weights on the toe. In 3 of the cases operative treatment was practised, the remainder being treated by plaster of Paris and supports.

I have observed the following case:

A woman, age 35, was injured two years ago by having the foot trod on while dancing. The acute symptoms soon disappeared, but there remained a residual soreness and pain on walking. Examination revealed nothing except slight tenderness over the site of the sesamoid bones of the left great toe. An X-ray made by Dr. Pfahler showed a transverse fracture of the tibial sesamoid with slight separation of the fragments, but no displacement. On June 27, 1911, I removed the sesamoid through an incision about one-half inch above and parallel to the tendon of the flexor longus hallucis. It was necessary to detach the inner head of the flexor brevis hallucis. The capsule was then cut and the joint opened. After removal of the fractured sesamoid the tendon was sutured to the capsule. The wound was closed without drainage. On October 2, 1911, the patient expressed herself as being entirely relieved of all pain and disability.

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[14] Muskat, Deutsche med. Woch., Jahr 32, s. 1319.
[15] Igelstein, Deutsche Zeit. f. Chir., 1908, Bd. 93.
[16] Stumme, Fortsche. auf dem Gebiet. du Röntgen, 1909, Bd. 13, s. 312.

NOTE.—There are two instances of luxation of the sesamoids on record, viz., Karschulin (Wiener med. Woch., 1906, No. 17, s. 814) and Perlman (Deutsche Militar. Arztl. Zeit., 1904, s. 474).

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting held November 8, 1911.

The President, DR. CHARLES L. GIBSON, in the Chair.

OSTEOMYELITIS TREATED BY A NEW METHOD.

DR. ROBERT H. M. DAWBARN presented a man who had suffered from osteomyelitis of the bones, whose life was undoubtedly saved through two steps in surgical technic, which perhaps were new.

The patient, a Russian Jew, 50 years of age, was admitted to the City Hospital with the following history: A few months prior to his admission he had received a compound fracture of the shaft of his right femur, the point of exposure of his marrow canal being not far from the middle of the thigh. The bone-marrow had became infected, and a surgeon in another hospital had curetted from this point in both directions, with temporary benefit only.

When Dr. Dawbarn first saw the patient, he found him emaciated and running a typical septic temperature. His pus proved to be almost a pure culture of streptococcus. Under spinal analgesia, with two grains of tropacocaine, he cut down upon the bone opposite the two ends of the medullary canal, chiselling into the shaft until the marrow was freely exposed. At the upper end, this point—the beginning of the marrow canal—was opposite the level of the lesser trochanter, and was entered from the outer side of the thigh. At the lower end the canal was found to commence at a level about above the adductor magnus tubercle. At this end he entered upon the inner side of the thigh, as this made only a continuation of the wound already present.

A coarse silver wire, with a tiny loop bent upon its end, was passed in at one extremity of the canal and out at the other. A stout fish-line was fastened to this wire loop, and thus drawn through. Upon the middle of a yard of this line was fastened a tightly rolled gauze sponge, the size of which made a comfortable fit for the bony canal, and by the aid of this blunt means he thoroughly did, what for want of a better term he called "pistoning out" the marrow, repeatedly drawing the piston-head from end to end of the canal.

Dr. Dawbarn said that although he had not heretofore published this procedure, he had now used it a considerable number of times in the course of the past few years, and thus far he had had only recoveries follow. He had used it repeatedly in the humerus and tibia as well as in the femur, and it had seemed to him that such blunt curettage must necessarily be far safer than would the thorough employment of any sharp implement, and that the danger of the infection spreading elsewhere was thus in a great measure prevented.

Of the three ways whereby any long bone was nourished, namely, (*a*) through the nutrient vessels, (*b*) those from the periosteum, and (*c*) those entering the bone from within the marrow canal, the last was by far the least important. Given a normal supply from the first two sources, he thought we need feel no anxiety over the loss of the third.

Dr. Dawbarn said that although he had been convinced that the removal of the entire marrow was the only wise way of handling any case where infection had begun to show itself, yet in this patient a further step in technic, new for this purpose so far as the speaker could ascertain, had so hastened the cure as compared with his previous operations of this kind that he would certainly employ it, whenever opportunity offered, immediately after pistoning and then flushing out, as he did in this instance. He alluded to filling the marrow canal entirely full of Beck's paste. The formula used was that as given by Dr. Beck in his book.

A DRESSING FOR FRACTURE OF THE CLAVICLE.

Dr. Howard D. Collins showed a patient to demonstrate this, and read a description of the method employed, for which see page 88.

PYONEPHROLITHIASIS.

Dr. Howard D. Collins presented a man, 35 years old, who was operated upon by the late Dr. Andrew J. McCosh 24 years ago for the removal of a bladder calculus by the suprapubic route. His recovery from that operation was uneventful.

The patient gave a markedly alcoholic history, and stated that three years ago, after a kick over the right kidney, he noticed an intermittent swelling in the right lumbar region, with attacks of pain in the kidney.

Upon admission to the City Hospital, on September 26, 1911, the swelling he described was not present, but examination revealed a hard mass just below and to the outer side of the gall-bladder. The diagnosis was made of a tumor of the right kidney. On October 11, 1911, by lumbar incision, a large, cystic kidney, weighing thirty-two ounces, was removed. The post-operative history was uneventful.

On section it was seen that most of the kidney had degenerated into multilocular cysts filled with thin pus. Many calculi were scattered throughout the cysts, and one large stone completely blocked the pelvis and ureter.

RETROPERITONEAL SARCOMA.

Dr. Frank S. Mathews showed a man, 50 years old, who had apparently been well until within three days of the time when he first came under observation, in April, 1911. While walking, he had been seized with a severe pain in the right iliac fossa, compelling him to go home to bed. This pain continued almost up to the time of operation, some days later.

Examination of the abdomen revealed a solid mass, extending from the ensiform cartilage to the pubes. It was a little more prominent on the right side, suggesting a solid growth of the right kidney, excepting that there was an area of tympany in the right loin.

Operation, April 26, 1911: An incision made through the right rectus muscle revealed a tumor, with intestine running over it. The incision was continued through the entire extent of the muscle, about a foot in length, until the tumor could be delivered. It lay behind the peritoneum, to the left of the cæcum, and behind the lowest part of the ileum. The latter was divided close to the ileocæcal valve and again three feet higher up. The tumor with its attachment was then enucleated from below upward until a pedicle containing an artery of considerable size was encountered. The pedicle was divided behind the transverse duodenum, and in the course of these manipulations, a rent an inch and a half long was made in the duodenum, which was sutured as carefully as possible because of the lack of peritoneal investment.

The end of the ileum and ileocæcal valve were now closed with sutures, and a lateral anastomosis completed between the ileum and the transverse colon under the omentum. The peritoneum and blood supply of the cæcum had been too much compromised to make it safe to use the cæcum for anastomosis.

The tumor, which weighed twelve and a half pounds, was an œdematous fibrosarcoma. Convalescence, so far as the operation was concerned, was uneventful, but during the second week the patient developed a serous pleurisy on the right side, and a dry pleurisy on the opposite side. These were assumed to represent a mild grade of infection, extending from the sutured duodenum to the mediastinum. Otherwise, the patient's convalescence was uninterrupted, and he had remained well since leaving the hospital.

FOREIGN BODY (STAPLE) IN THE MEDIASTINUM.

DR. MATHEWS presented a boy, 15 years old, who was sent to the hospital because of an unresolved pneumonia of three months' duration. He had a persistent elevation of temperature, and at times spat up considerable quantities of pus. The breathing sounds were very faint over the entire left chest, with flatness on percussion over the lower two-thirds, and dulness at the apex. No tubercle bacilli were found in the sputum.

An X-ray picture was taken, which showed a wire staple lying one inch to the left of the median line in the sixth interspace, posteriorly. A picture taken from the side showed that the staple lay one inch in front of the vertebral column. Upon inquiry, the boy stated that he had swallowed the staple years before; his father said it was about seven years ago, and he also recalled that there had been no cough nor other immediate symptoms.

In order to locate the foreign body more exactly, a tube filled with bismuth was inserted into the œsophagus, and with this *in situ,* radiograms were taken which showed that the staple lay three-quarters of an inch to the left of the œsophagus, while with the lateral views the shadows of the staple and of the bismuth tube in the œsophagus partly overlapped.

Foreign bodies in the bronchus, Dr. Mathews said, usually appeared in the radiograms in the fifth space posteriorly, *i.e.,* between the origin of the fifth and sixth ribs. In this case, on account of the low situation of the foreign body, its proximity to the median line, the long time that it had been present, and the symptoms to which it gave rise, it was thought probable that it lay in an abscess cavity communicating with the left bronchus. Consequently, it was determined to attempt its removal by resection of a portion of the seventh rib close to its angle.

By elevating the arm, the scapula and trapezius muscle were got out of the way, and the seventh rib was resected. The exposed lung was fairly soft to the touch, and with the pulsating aorta and the vertebral body as guides, an effort was made to introduce the finger between lung and pleura toward the root of the lung. Bleeding was profuse, and neither staple nor abscess cavity were located.

Subsequent to this operation, a probe, three and a half inches long, was inserted through the operation wound to represent as nearly as possible the exploring finger, and with this in position, two radiograms were taken. Both showed that the point of the probe was separated from the staple by about one-quarter of an inch. At a second operation it seemed at first as though the tip of the finger felt the staple, but only for an instant, and after as prolonged a search as was deemed safe, and the removal of a part of the sixth rib to facilitate exploration, further efforts to locate the staple were given up. The patient had scarcely been returned to bed when he had an attack of vomiting and expelled the staple, which presumably had been dislodged into the bronchus by the exploring finger.

The staple measured half an inch from point to point, and was much corroded. Following the operation, the sinus rapidly healed and the lung symptoms had largely cleared up. The case was remarkable on account of the length of time the staple had remained imbedded without causing symptoms.

GUMMA OF THE LIVER AS A SEQUEL TO YAWS.

Dr. Henry H. M. Lyle presented a man, a native of West India (Grenada), 49 years old, whose father and one uncle died of carcinoma of the stomach. The patient gave a history of having had gonorrhœa 15 years ago, and yaws (frambesia), 39 years ago. There was no history of syphilis. He had complained of gastric trouble for 30 years, and at various times he had been treated for gastritis, ulcer, and carcinoma.

Since February, 1911, the patient had complained of a constant gnawing pain in the stomach. This came on about an hour after eating, and persisted until the following meal or until relief was obtained by vomiting. Recently, the pain had become constant and had kept him awake at night. A month ago he noticed a fulness in the upper epigastrium. He complained of weakness, and had lost 40 pounds in weight. A blood examination was negative, an analysis of the stomach contents showed hyperacidity.

An examination showed that the patient was much emaciated. No glandular involvement could be made out. There were several old scars on the arms and legs which were said to have been the result of yaws. In the midline of the abdomen, one inch below the ensiform cartilage, there was a smooth, hard mass, which apparently lay below the edge of the liver. Dilatation of the stomach caused this mass to disappear. The spleen was not enlarged. The case was regarded as one of carcinoma of the stomach starting from an old ulcer.

At the operation, a smooth, round tumor, about the size of a mandarin orange, was found on the anterior surface of the left lobe of the liver. The liver was enlarged and congested. The stomach, pancreas, and spleen were normal, and the mesenteric glands were not enlarged. As an extended search failed to reveal any other lesion, a diagnosis of gumma of the liver was made and the abdomen was closed.

Of two Wassermann tests that were made, the first was negative, the second doubtful. After an intravenous injection of salvarsan a third Wassermann test was made, which was positive. Under specific treatment, the tumor had disappeared and the liver had grown smaller.

The interest in this case, Dr. Lyle said, rested largely on the possible relationship between yaws and syphilis. The patient with two other members of his family was isolated in a hospital given over to the treatment of yaws. Under these circumstances it is reasonable to assume that the diagnosis of yaws was correct.

It has been said that an attack of yaws gave an immunity to syphilis. If this is the case the patient must have had his syphilis before his yaws.

In reply to a question as to the nature of yaws, Dr. Lyle said it was supposed to be very closely allied to syphilis. It was caused by a spirochæta, and there had been much discussion as to whether or not it was a variety of syphilis. It had also been found that in the Fiji Islands, where yaws was very prevalent, the natives were practically immune to syphilis. The primary lesions were found on the skin surface, usually the hands or feet.

THE BOTTLE OPERATION FOR HYDROCELE OF THE TUNICA VAGINALIS.

Dr. Lyle presented a man, 38 years old, who had been operated on for a simple hydrocele of the left tunica vaginalis. From a clinical and operative standpoint, this case appeared to be an ideal one for the "bottle operation." In a series of ten cases in which this operation had been done by him, there had been three failures. The first of these failures could not be justly charged to the operation, as the patient had a chronic cardiac condition which might have been a factor in the passive congestion of the reversed sac. In the second case, the surgical indications for this operation were apparently perfect. The failure was a complete surprise, and led Dr. Lyle to think that it must be due to an error in technic, such as constricting the cord by the reversed sac. As this patient refused further operative interference, the cause of the increased size of the sac and testicle remained problematic.

In the third case with the previous failures freshly in mind, the operation was carefully and deliberately carried out. The hydrocele tumor disappeared, but its place was gradually taken by a tumor which was composed of thickened sac and testis. This secondary condition was little or no better than the primary. Two months later, the reversed sac was excised, when the sac wall was found to be half an inch thick. No microscopic examination was made.

Dr. A. V. Moschcowitz said he had abandoned the "bottle operation" for hydrocele for practically the same reason as that given by Dr. Lyle, although it was still occasionally done at Mt. Sinai Hospital, and in one case where it was done six weeks previously, the patient had since been re-admitted with a recurrence. As a matter of fact, Dr. Moschcowitz said, there was a good theoretical reason why the operation should not be done. In the majority of instances, the testis was fastened to the bottom of the scrotum by the remains of Hunter's ligament or the ligamentum scrotale. To perform the operation properly, this ligament ought to be cut and the whole tunica everted and sutured. But if this is done, it is just as easy, in fact easier, to cut it away entirely, in other words to do a Bergmann operation, which has of late years been his operation of choice.

Dr. F. Kammerer said he was rather surprised to hear of the bad results following this operation, which he had been doing a number of years. He could not recollect that it had ever been followed by a recurrence in his hands or by any other untoward symptoms.

The operation seemed to him simpler and less formidable than the extirpation of the entire tunica vaginalis according to Von Bergmann, and, if the results were as good, it should have preference.

Dr. Gibson said he thought the Winkleman operation had hardly been described a year before discouraging reports began to come in about it. Personally, he did not look upon the Von Bergmann operation as a formidable one, because after the exposure of the tunica vaginalis most of the operation was practically done.

CHRONIC PERISIGMOIDITIS WITH PARTIAL VOLVULUS.

Dr. Lyle presented a man, 50 years old, who entered St. Luke's Hospital in September with the diagnosis of acute intestinal obstruction. Two months ago he began to suffer from attacks of pain and distention in the left iliac region. These symptoms were distinctly localized. The attacks, as a rule, were preceded by severe frontal headache, and relief was obtained by movement of the bowels.

Two days prior to his admission to the hospital, he had a splitting headache, which compelled him to give up his work. He took a cathartic which set up violent peristalsis, resulting in ten or twelve movements of the bowels. These were at first fecal, but soon became mucoid and bloody. Following this, the patient was seized with a violent pain in the left iliac region, and he vomited several times. With the onset of the pain, the movements of the bowels ceased abruptly. No gas was passed.

Upon admission, the patient presented the picture of an acute intestinal obstruction. There was moderate general distention of the abdomen, with marked local distention and tenderness in the left iliac region. The patient's temperature at this time was 100°; pulse 120. There was a moderate leucocytosis, with no relative increase in the polymorphonuclears.

After lavage and repeated enemata, the distention was reduced, and some gas was passed per rectum. As the symptoms were apparently improving, an operation was deferred, the patient meanwhile being kept under close observation. With the reduction of the distention, a distinct mass was made out, which gave the impression of a thickened intestine. The most probable diagnosis seemed to be an obstruction from a new growth.

Upon operation, the sigmoid was found to be covered with broad, veil-like adhesions; the lower edge of this veil was tough and fibrous, and it extended from the parietal peritoneum across the sigmoid. Around this as an axis the sigmoid had partially revolved. The band was freed, and the sigmoid straightened out. The presence of the veil-like adhesions showed an attempt on the part of nature to limit a dilated and movable sigmoid.

CONSTRICTION OF THE LOWER END OF THE DUODENUM.

Dr. F. Kammerer showed the specimen in this case. The patient was a man of 40, who came to the hospital with the history of gradually increasing inability to retain food, and for two weeks prior to his admission he had been vomiting continually, and was in a condition of extreme emaciation. Every attempt to take food induced vomiting, the vomitus containing much bile.

Palpation of the upper abdomen was negative. No peristalsis nor contraction of the stomach could be observed; there was no jaundice. On opening the abdomen, the previous diagnosis of an obstruction beyond the ampulla of Vater was confirmed. The stomach and pylorus were normal, although somewhat distended. The duodenum was very much distended. On raising the greater omentum and exposing the root of the mesentery, a tight stricture was found at the duodenojejunal junction. The body of the pancreas contained a hard mass, toward which the strictured intestine was drawn, and to which the stomach was also adherent.

Posterior gastro-enterostomy was done. On the day following operation the patient showed the beginning of a toxic condition—high temperature and pulse, dry tongue, restlessness and twitching—to which he gradually succumbed on the third day. An examination of the lungs, heart, and abdomen offered no explanation of this condition, and there was no indication whatever of peritonitis. Vomiting had ceased after operation, and during the last two days of life the patient took a fair amount of liquid food. At the autopsy, a cancer of the body of the pancreas was found which had gradually invaded the intestinal walls at the point of stricture. The head of the pancreas was not involved, and the duodenum, although intact, was still slightly distended. There was no trouble at the site of the gastro-enterostomy, union being perfect.

ACUTE INTESTINAL OBSTRUCTION DUE TO INTUSSUSCEPTION.

DR. DAWBARN showed a photograph of this case, which was one of acute intestinal obstruction high in the ileum, due to intussusception, in which some thirty inches of small intestine were excised. The patient died shortly after the operation. He had suffered a week, and perhaps longer, from complete obstruction, and the photograph shows that upon the proximal side of the intussusception the bowel was not only dead, but on the verge of separating by sloughing from the living intestine.

EXPERIMENTS ON HIGH INTESTINAL OBSTRUCTION.

DR. JOHN A. HARTWELL briefly reported the results of some experiments performed by Dr. J. P. Hoguet and himself in the Cornell Laboratory to determine the cause of death in high intestinal obstruction. He reviewed the literature and outlined the three accepted theories concerning this phenomenon, namely, first, the reflex nervous action on the cardiovascular centres; second, the bacterial invasion outward from the intestinal lumen either into the peritoneum or into the blood itself; third, the absorption of toxins from the intestine, these toxins being derived either from the bacteria, from food decomposition, or from secretory activity of the glands of the intestine, the pancreas, and the liver.

The experiments of Dr. Hartwell and Dr. Hoguet did not deal with the first theory, but the experimenters agreed with the majority of authors that no good evidence in support of this reflex action had been forthcoming, and that the other two theories, at the present time, had much more in their favor.

The obstruction in these experiments was produced in two ways: first, by sectioning the gut in the upper jejunum; and second, by applying a special clamp in such a way as to produce obstruction, with no interference with the circulation. All obstruction was done between the pancreatic duct and a point 34 cm. distal to the pylorus. The operation was done at varying times after the animal had eaten—from 6 to 72 hours. By the first method, one cat and six dogs were operated. These animals lived an average of 67 hours, the longest period being 160 hours. The length of life did not seem to be influenced either by the interval of time elapsing after the last pre-operative feeding or by the distance between the pylorus and the obstruction, within the limits above named. Bacterial examinations were made from the femoral blood, from the liver, the spleen, and the peritoneum in many of the cases, and as a result, organisms, principally the colon bacillus, the Welch bacillus and a Gram negative coccus were found in nearly every instance in some or all of the tubes. These examinations were made, however, some hours postmortem, as the animals invariably died in the night.

A microscopical study was made of the kidney, spleen, pancreas, and liver in many of the cases. Very marked lesions were found in the kidney tubules and in the liver-cells in the shape of granular degeneration, and in some instances an actual necrosis. Sections of the intestine above the obstruction also showed marked evidence of an acute inflammation, but no actual ulcerations were present.

By the second method, the obstructing clamp, eight animals were operated on. The average life here was about 140 hours, two dogs living for ten days. These dogs were not allowed to die, but were killed when it was apparent that they could not live through another night, and the bacteriological examinations were immediately done. The cultures in these cases were uniformly sterile, while the microscopical changes were the same as in the other cases. These animals seemed much less sick from the start than the first series, and they lived twice as long. The behavior of the dogs in both series after operation was much the same, and the one striking and constant symptom was progressive emaciation and weakness. The temperature was in some cases a little elevated, but the average was about 38° C. The pulse in some cases was rapid, but not uniformly so, a count of 140 often being made, which was not very much above the normal. There were never any evidences of dyspnœa. No convulsions were noted and only occasionally a rigidity of the muscles of the hind legs. This was never very marked. The dogs all drank water freely and vomited it promptly, washing out bile and mucus. They were given no food post-operative. Vomiting was not a prominent symptom excepting when the water was taken, although some did vomit at other times late in the disease. The last five dogs operated on were given normal saline solution subcutaneously in amounts of 150 to 300 c.c. per day, and this seemed to exert a very beneficial effect.

The results of these experiments were compared with those done by other workers, and it seemed that the use of the clamp without disturbance of the circulation and the hypodermoclysis exerted a very decided influence in lessening the severity of the toxic symptoms and prolonging life. The experiments were entirely inconclusive in determining the actual source of the toxins.

The following summary of the facts observed was given:

1. A high intestinal obstruction in dogs (*i.e.*, 10 to 30 cm. distal to the pylorus, but always distal to the pancreatic ducts) may not cause death for ten days.

2. There is no direct relation between the length of life and the distance of the obstruction within the above limits below the pylorus.

3. Starved dogs—48 to 72 hours—may die just as promptly as those fed 10 to 20 hours before the obstruction. Decomposition of food residue does not, therefore, seem to be an essential

factor in causing death. Operation done on a full stomach—fed under six hours—may be accompanied with much shock.

4. Bacterial invasion of the blood and organs does not necessarily occur.

5. Dogs in which the obstruction was produced without damage to the gut wall lived twice as long and seemed less poisoned than those in which the obstruction was accompanied by local damage.

6. Hypodermoclysis of normal saline was very beneficial.

7. Microscopical examination of the tissues showed marked degenerative changes similar to those produced by many toxic materials, both bacterial and non-bacterial.

Dr. Hartwell and Dr. Hoguet acknowledged their indebtedness to Drs. Elser, Ewing, and Lusk, of the Cornell Medical School, for very valuable aid in conducting the experiments. All the animals were fully narcotized with ether during all operative work.

Dr. George Woolsey said that in the experiments reported by Dr. Hartwell, the effects of the intestinal obstruction seemed to be of a toxic nature. Experiments have shown that the filtered contents of the obstructed intestine in man when injected into animals produce no effect or a very uncertain one. The symptoms due to the injection of the contents of the intestine of animals, artificially obstructed, into other animals are not those of intestinal obstruction. The pulse and blood-pressure counts in cases of advanced intestinal obstruction resemble those of collapse or hemorrhage. V. Brun draws the conclusion that the cause of death in intestinal obstruction, unaccompanied by peritonitis, is an intense congestion of the splanchnic vessels, which has the same effect as a hemorrhage into them, causing central anæmia. This is borne out by the findings in operations in such cases in which the splanchnic vessels, especially the veins, are intensely congested. Whether this explanation would apply also to cases of obstruction high up in the intestine, which was the subject of Dr. Hartwell's experiments, the speaker was unable to say.

Dr. Vosburgh said that in a number of cases he had observed, the obstruction was usually low down; hence, hardly pertinent to the subject under discussion. In one case of intussusception in a child where the obstruction had lasted for five days, the patient showed no evidences of toxæmia, and the abdomen was soft and flat. The picture presented was more one of shock than of toxæmia, and the condition found at operation was simply disintegration of the bowel. In other cases where the intussusception was of shorter duration, say within 24 hours, the children scarcely seemed sick at all, and the diagnosis was made on the absence of stools and the presence of blood and mucus. When these children were relieved by devagination of the intussusception, they usually recovered promptly and completely without any evidence of toxæmia. Dr. Vosburgh said that, in his opinion, the toxæmic theory which had been offered as an explanation for the symptoms in cases of intestinal obstruction was still unproven.

Dr. Hartwell, in closing, said that in his paper he did not go into the symptoms that had been given for determining the presence of these poisonous substances, because it did not seem to him that they proved the point. There was no positive proof at present that *any particular toxic substance* was developed. On the other hand, there was no proof to support the reflex theory, and the theory of bacterial invasion had been thrown out, so that the toxic theory was the one that was now being elaborated in search of proof.

Dr. Hartwell, in reply to a question, said that so far as he knew, no experiments had ever been made to determine how long animals might live when deprived of both food and water, but it certainly would be a matter of many days provided they received saline subcutaneously as these dogs did. In reply to Dr. Woolsey, who referred to splanchnic congestion and shock after intestinal obstruction, Dr. Hartwell said that in their experiments there was no shock nor marked congestion. Dr. Vosburgh's cases referred to obstruction low down in the intestinal tract, which was an entirely different matter, and the cases could not be compared to those where the poisons were blocked up in the duodenum.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, October 2, 1911

The Vice-President, Dr. G. G. Davis, in the Chair.

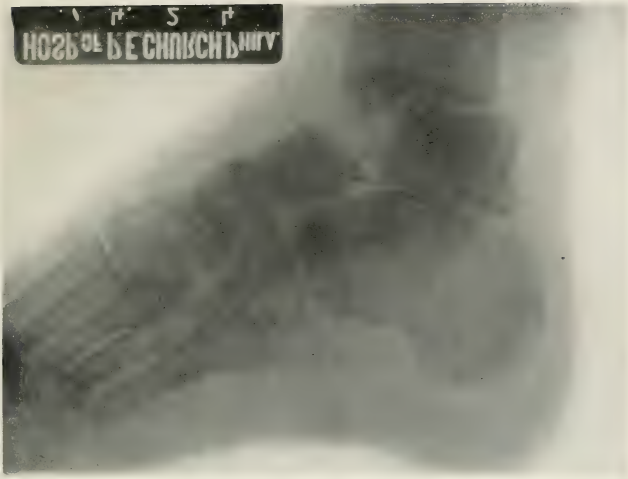
EXCISION OF THE ASTRAGALUS FOR FRACTURE-DISLOCATION.

Dr. Astley P. C. Ashhurst presented a man aged 45 years, who was admitted to Dr. Frazier's service in the Episcopal Hospital on August 2, 1911. He had just fallen a height of about 8 or 9 feet, into a hole, landing on his feet, and injuring the left ankle.

Examination showed considerable swelling around the left ankle, but the skin was unbroken. The foot was held in slight plantar flexion but could not be brought up to a right angle with the leg; plantar flexion was possible to the same degree as in the uninjured foot. Lateral motions were very painful and limited. The leg bones were uninjured. The head of the astragalus could be felt beneath the skin, anterior to its normal position, but still articulating with the scaphoid, and retaining its normal relation to the cuboid; beneath the tendo Achillis the posterior margin of the astragalus could be felt indistinctly. The foot was in slight "cavus" position, the anterior tarsus and metatarsus dropping.

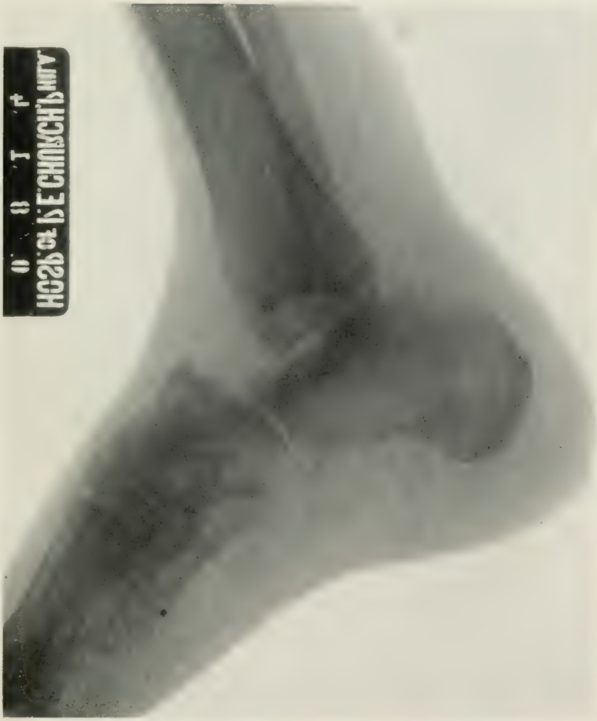
A skiagraph (Fig. 1) showed a transverse fracture through the neck of the astragalus, the posterior fragment being dislocated backward leaving only about half of its articulating surface still in contact with the mortise of the ankle-joint. The relation of the posterior half of the astragalus to the calcaneum was not disturbed. The anterior fragment of the astragalus was dislocated forward and outward, the fragments of the astragalus being separated by about one inch and a half.

FIG. 1.



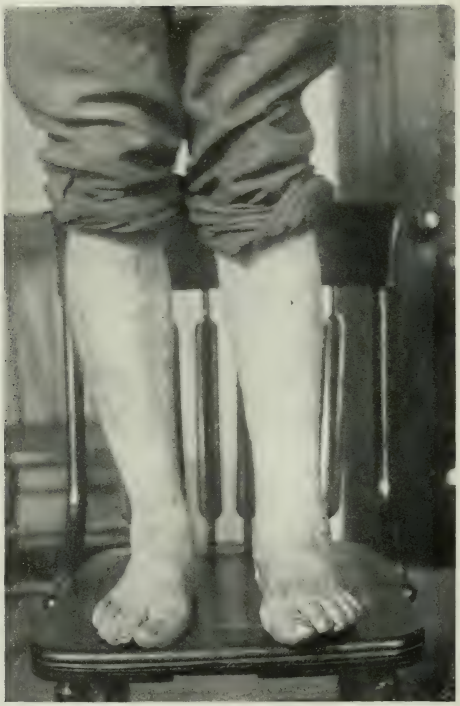
Fracture-dislocation of astragalus.

FIG. 2.



Fracture-dislocation of astragalus. Condition after excision of astragalus.

FIG. 3.



Showing result seven weeks after excision of astragalus for fracture-dislocation.

The dislocation was irreducible, so it was determined to incise the soft parts and if reduction still was impossible, to excise both fragments of the astragalus.

Operation, August 5, 1911, three days after injury. No Esmarch band was employed. An incision about two and a half inches long was made from below the external malleolus forward to the extensor tendons. A hæmatoma was evacuated from between the fragments; the external lateral ligament of the ankle was found ruptured; the fragments of the astragalus were about an inch and a half apart, and a few loose fragments were present, also belonging to the astragalus. Reduction of either fragment proved impossible. The anterior fragment was then excised without much trouble; but removal of the posterior fragment was very difficult, though finally it was delivered entire, after division of the tendo Achillis (subcutaneous tenotomy). The ruptured external lateral ligament was sutured with chromic catgut, and the wound was closed with buried and skin sutures of the same material. A small rubber tube was introduced into the ankle-joint for drainage, and the foot and leg were encased in plaster of Paris. The time of the operation was about an hour and a half.

The day after the operation the rubber tube was removed through a small window cut in the gypsum case, but the case itself was not removed for six weeks. There was no rise of temperature after the operation, and the wound was found cleanly healed and the sutures absorbed at the first dressing, six weeks after operation. Another gypsum case was worn for a week longer, and the patient encouraged to use the foot in walking.

The photograph (Fig. 3) made seven weeks after operation shows slight thickening and shortening of the foot. Flexion and extension are very nearly normal in extent and painless. Lateral motion is restricted, but sufficiently free, and painless. There is scarcely any disability, and the patient already can walk several squares. Fig. 2 is a skiagraph made eight weeks after operation.

Dr. George P. Müller reported a somewhat similar case seen in the University Hospital in Dr. Frazier's service. The patient, a man 50 years old, had an iron beam fall on his foot. There was a dislocation of the internal cuneiform, inwards and forwards, and a fracture of the second metatarsal, the fragments remaining in good position. He was unable to reduce the dislocation under anæsthesia or after making an incision, and accordingly sawed off the projecting portion. There is now good function.

Dr. G. G. Davis recalled a case of dislocation of the scaphoid in which the bone was still out; it was an old case. It seems that the bone never goes back again, its position not altering much. Dr. Ashhurst's case shows that the good results are lasting, even after as big a bone as the astragalus is removed.

Dr. T. Turner Thomas had seen two cases of subastragaloid dislocation, in one of which he knew there was a fracture and in the other he believed there was. His own case, which was not compound, was a subastragaloid dislocation with a fracture of the astragalus. He had a great deal of trouble trying to reduce the dislocation. He looked up the literature, and found in most of the reported cases of subastragaloid dislocation there was great trouble in reduction. It seemed to him that when dislocation is associated with fracture of the astragalus the reduction becomes extremely difficult. Some cases, for some reason, go back easily, others, and these the majority, do not go back in spite of the pushing and pulling. His patient, a man of 60 years, was thrown from a horse; the foot was turned at right angles to the leg. Under ether a vigorous attempt at reduction was made, which was only partially successful. The following day after a consultation with Professor J. William White, the patient was again etherized after Dr. Thomas had made an effort to study out the problem on the cadaver, using one of Dr. Davis's anatomical specimens, upon which he based a theory as to the difficulty to be overcome, and he secured an easy apparent reduction. He put on a plaster case. A week later he took off the case but the reduction was not complete, and he had since had a good deal of trouble with that foot. The last time he saw the patient he was somewhat worse than when he took off the case. In some of these cases the patients have not only lost their limbs, but in some instances their lives.

He had the opportunity of seeing another case with Dr. A. C. Wood at the Philadelphia Hospital less than a year ago. His own case had been of the internal variety while Dr. Wood's was of the external variety. Under ether a pull was made on the foot (Dr. Wood fixed a sling about the foot) and the whole thing slipped easily into place.

A STUDY OF SPRAIN-FRACTURE.

Dr. Lever S. Stewart (by invitation) read a paper with this title, for which see page 70.

Dr. George G. Ross said that this question of sprain-fracture is one in which he had long been interested. He had felt that the so-called explanation of sprains was very inadequate. Text-books all say that a sprain is an injury about a joint in which the tendons are stretched or torn. Tendons and ligaments are made of white fibrous connective tissue which is absolutely inelastic and of great strength, being the strongest tissue in the human body. He had felt that it was very difficult, if not impossible, to tear or break a normal tendon or ligament. Fortunately the X-ray then came along to help confirm the suspicion that it was the attachment of the tendon or ligament that gave way, and not the tendon or ligament itself. John Ashhurst's Surgery, next to the last edition, has a footnote in which reference is made to Callender's remark on sprain-fracture. He asked Dr. Stewart to take up this matter last summer and do some experimental work. The present paper records the results of this work. It seemed to him that the pathology as explained by Dr. Stewart's experimental and clinical work is conclusive proof that sprain is fracture, and being fracture should be so treated. This fracture has been termed the drug-store fracture, for after a treatment with liniment it comes to the surgeon with what is called a sprained joint which does not get well but remains painful the rest of the patient's life, because it was a fracture that was not properly treated. It seems important enough to warrant treatment of the same as a gross fracture of a bone. The way it occurs is that sufficient violence, not necessarily great in extent, is exerted when the tendons and ligaments about the joint are in a certain state of tension, as, for instance, when a person turns on the side of the foot, putting the external ligament on a great tension, and then a little additional twist is all that is necessary to detach the ligament.

Dr. Astley P. C. Ashhurst remarked that sprains, as he understood them, are injuries to joints consisting in the rupture or laceration of ligaments, due to indirect violence. If ligaments do not rupture in their body they must be torn through in their attachments to the bone. There are certain sprain-fractures so typical and recognized that they have received distinct names, such as *Schlatter's disease,* or "starting" of the upper epiphysis of the tibia; the *epiconaylitis* of Momberg, or sprain-fracture of the external epicondyle at the elbow. Then there are such cases as Dr. Wharton reported to this academy several years ago, and of which he had seen several instances, a sprain-fracture of the tuberosity of the fifth metatarsal. However, this last often is due to direct injury, the patient tramping on the outside of the foot. These three types especially he thought deserving of recognition as typical injuries, but most others he should consider as sprains. To have sprain-fractures occurring in 15 per cent. of all sprains increases the total number of fractures to an alarming degree.

Dr. T. Turner Thomas did not believe that all sprains were really sprain-fractures. He had seen in experimental work on the shoulder-joint of cadavers the tearing of the ligament from the glenoid margin and from the humeral attachment without associated fracture. He had on the cadaver repeatedly produced sprains of the ankle by fixing the foot in the vice and pulling the leg over, every time getting a sprain-fracture. Now, he had been doing some work on dislocations of the shoulder and at the bottom of this work is the idea of sprain and sprain-fracture, a dislocation being nothing more than an exaggerated sprain. He believed that the condition described by Codman as due to a subacromial bursitis is the result of sprain-fracture, at the shoulder-joint. Forced abduction is to the shoulder what a lateral turn of the foot is to the ankle, and what forced dorsal flexion from a fall on the hand is to the wrist. The effect of forced abduction on the shoulder is to tear the ligamentous attachment on the axillary side. Rather frequently a tearing off of a small portion of the internal glenoid margin will be produced. He had often found roughness of the glenoid margin. He had found similar fractures reported in the literature. Far more important, and not recognized as such, is a tearing fracture at the shoulder of the greater tuberosity. As abduction is forced it tears the axillary portion of the capsule, and if abduction is continued, as the humerus strikes the edge of the acromion the head is violently forced out and the external rotators with the underlying portion of the capsule pulling back on it give way. This is an extremely important accident, and occurs more frequently than is credited. If one tears off the greater tuberosity with the underlying capsule, or if the capsule alone is torn from the greater tuberosity and these edges become separated, when the dislocation is reduced the head of the humerus drops and this is always associated with severe paralysis of the upper extremity that never completely recovers. He had found that condition associated with a fracture of the greater tuberosity as shown by the X-ray and as shown in the operations by irregularities of the tuberosity. This idea of fracture of the greater tuberosity from forced abduction is in line with the views of the reader of the paper.

In line with the thought that forcible abduction is an important movement, practically all of the dislocations of the shoulder in the adult are anterior dislocations, and the reason is because they are due to forced abduction which is very common and can produce only an anterior dislocation. As the head goes out and the pull comes on the supraspinatus, the infraspinatus, the teres minor and corresponding portion of the capsule, the capsule may tear, the greater tuberosity may tear off, and the subacromial bursa, which lies on and is intimately adherent to the greater tuberosity and tendons attached to it, must be involved in the inflammation, this is the reason why Codman and others have found adhesions in the bursa. Codman has recently reported two cases in which he sutured the two ends of the torn supraspinatus, and he has very much limited the causative factors in subacromial bursitis. He now believes subacromial bursitis is usually due to tearing of the supraspinatus tendon, and this again is frequently replaced by a tearing of the greater tuberosity, so that inflammation in the bursa should be common. Its importance, however, is secondary to the laceration of the axillary portion of the capsule, which is necessary to the mechanism of the tearing of the tendon or the tuberosity. Wherever there is a fracture of the greater tuberosity of the humerus there has been a dislocation of the shoulder, and in those cases in which there is no history of a dislocation, the latter did occur at the moment of forced abduction, but was spontaneously reduced as the arm fell to the side of the body immediately afterward.

Dr. G. G. Davis was under the impression that the reader in his experiments stated that whenever the tendon was pulled until something gave way, that it was the bone which yielded. That such is not always the case in man is shown by the many cases of rupture of the quadriceps, and the biceps tendons, but it raises the question as to whether or not some of these conditions may not be examples of sprain-fractures. We can account for others by disease of the tendon; he had a preparation which shows the long tendon of the biceps very markedly diseased by osteoarthritis, which caused its rupture at its exit from the capsule.

Dr. John H. Jopson said that the truth as brought out in these cases lies in a middle ground rather than on the plane which the essayist would have us believe, in other words between his position on the one hand and Dr. Ashhurst's on the other. The essayist says that his cases were not attended by laceration of the ligaments of the joint and were therefore not sprains according to Ashhurst. That all sprains and dislocations are attended by fractures of bones he did not think the majority believed. All have operated on cases in which ligaments or tendons have been torn from bones without fracture of the bone, as in rupture of the long head of the biceps, where it has been torn from its point of origin, and in rupture of the quadriceps tendon so-called where the tendon is torn away from its attachment to the bone, probably as often as its separate fibres are torn through. On the other hand fractures frequently accompany both sprains and dislocations. He had operated on a case of dislocation of the shoulder attended by fracture of the anatomical neck of the humerus in which the anterior lip of the glenoid cavity was torn off.

Dr. George G. Ross rejoined that the point they made is that it is the periosteum and the bone to which the ligament is attached that gives way and not the white fibrous tissue. They believed these so-called sprains are fractures of a minor degree. With regard to the quadriceps extensor above the patella he had seen one case of complete tear of the ligamentum patellæ without fracture. The patient was a colored man of 80 and his tendons and ligaments were all in a state of senile pathology that predisposed toward tearing. He did not deny the fact that he had seen a tear of the tendon of the quadriceps extensors, but the vast majority near the joints are sprain-fractures, and he believed this to be the true pathology of sprains.

Dr. Willis F. Manges agreed with the essayist that the occurrence of sprain-fracture is far more common than has heretofore been appreciated. He found this out by his X-ray work. It is surprising how small a fragment of bone can sometimes be clearly demonstrated. On the shoulder-joint particularly, where the condition is sometimes called a subdeltoid or subacromial bursitis, he had often taken the view that we are dealing with a sprain-fracture to which little attention was paid at the time of injury, and there has ensued an inflammation which remains more or less chronic until a subsequent wrench produces violent pain in that region. On the other hand, he believed that there are quite severe sprains or injuries around the joints where there is certainly no demonstrable portion of bone torn from the bone. Whether or not the ligament itself tears, or its attachment tears without fracturing the bone, he could not say. He did know, however, that the sprain-fracture is not uncommon.

Dr. Astley P. C. Ashhurst added that he recognized a fracture, a sprain, and a "sprain-fracture," but to call all these injuries, which have heretofore been called sprains, sprain-fractures, he thought would only serve to add confusion to what already is sufficiently clear. As to the possibility of ligaments being torn elsewhere than at their insertions, in the patient he showed earlier in the evening he found that the external lateral ligament of the ankle-joint had been torn through the centre; there was no fracture of the fibula or calcaneum which he could see. The rupture had taken place through the body of the external lateral ligament and he sewed it up again.

Dr. Morris Booth Miller said that a distinction should be made between a sprain which involves solely the ligaments and a strain which is an injury to tendons, fascia, or muscles. A look at the specimens presented by the essayist shows that they represent shells of bone pulled off by tendons and hence are examples of fracture strains and not fracture sprains.

Dr. G. G. Davis added that in making artificial luxations on the cadaver sometimes are found shells of bone sticking to the band-like ligaments, but at other times the bony edges are not broken. As to the question of relative frequency, and to solve this question, more careful radiographic observations must be made.

Dr. Lever F. Stewart (in closing) said that in these experiments, which, by the way, were done on living dogs, it was found that the sprain-fractures were sometimes so infinitesimal that they could not see but could only palpate the fragments. It is quite reasonable to suppose that in these cases the X-ray cannot demonstrate such small lesions. He referred to what had formerly been called severe sprains as sprain-fractures, and suggested that similar cases with symptoms of less severity were better called strain than sprain, providing, of course, that sprain-fracture is not demonstrated in them.

FRACTURE OF THE FLOOR OF THE ACETABULUM.

Dr. Penn Gaskell Skillern, Jr., and Dr. Henry K. Pancoast presented a paper with the above title, for which see page 92.

Dr. Astley P. C. Ashhurst said that in a recent paper on this subject by Henschen, in which 139 cases were collected, it was said that no attempt should be made to reduce the intrapelvic spicules of bone until the femoral head had been withdrawn from the pelvis; Henschen advised that the thigh be dressed in flexion and adduction in a plaster case, and that the patient should bear no weight on the limb for two or three months.

TRANSACTIONS

(IN PART)

OF THE

GERMAN SURGICAL SOCIETY*

Fortieth Congress held April 19-22, 1911.

GENERAL SURGERY, PATHOLOGY, AND THERAPY.

I. DISINFECTION OF THE HANDS AND SITE OF OPERATION.

Dr. H. Küttner (Breslau) reports researches made since the 27th Surgical Congress (1898), when V. Mikulicz made his important report. Answers by 210 German, Austrian, and Swiss surgeons had been obtained to a series of practical questions covering: what means to guard against, what to adopt, and what on account of ill results to abandon; and these formed the basis of Küttner's report.

After the exact investigations of Paul, Krönif, Sarwey, Gottstein, and Haegler had proved without doubt that none of the existing methods was able to render both hands and skin bacteria free, efforts were made to the following ends: (1) To obtain an antiseptic that would answer the purpose. (2) To ascertain whether or not mechanical means would be superior to chemical means. As it is impossible to destroy the bacteria perhaps they could be so fixed to the skin that they would stick fast to it, and not be loosened, thus not getting into the wound. (3) To prevent direct handling of the wound by using impervious materials.

1. *New, Practical Antiseptics.*—The mercury preparations, practically, as well as the formalin derivatives, did not prove powerful enough to kill organisms. The newer phenol preparations were apparently better. Bechold and Ehrlich have shown that the halogen derivatives of phenol possess almost inconceivable antiseptic properties. Laubenheimer demonstrated that a 2 per

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* Translated from the Beilage zum Zentralblatt für Chirurgie, No. 29, 1911, by Oswald Joerg, M.D., Max Lederer, M.D., and James Taft Pilcher, M.D.

cent. lysol solution in mercury bichloride, 1 per cent., has at least the power to destroy the pyogenic organisms; while the value of the bichloride alone—one might say exaggerated value—depends on the almost specific effect of this chemical upon certain spores used in earlier investigations. Laubenheimer found that the antiseptic property of chlormetakresol is not diminished in egg albumin, that it is not toxic, and that it is not very soluble in alcohol. With this substance the hands were rendered germ free in about 8 minutes. Likewise Bechold and Ehrlich have succeeded in destroying the *Bacillus coli communis* within 8 minutes, using a 1 per cent. solution of tritetrabromnaphthol; a control of 1 per cent. phenol requiring 60 minutes for the same purpose. Küttner brings these results forward with the hope that operators will find them as successful. Chlormetakresol is being used by two operators; one is pleased with it, while the other finds it causes severe itching of the skin.

2. *Mechanical Disinfection.*—By thorough mechanical cleansing of the skin, undoubtedly much of the superficial uncleanliness is removed, and at the same time many of the bacteria from the deeper layers of the skin are brought to the surface. Various objections against the Vogel hot-air apparatus for sterilization of the field of operation render it useless for practical purposes. Of the latest means recommended, alcohol gives at least as good results as do the older methods, especially that of Fürbinger. Ideal sterilization is not effected by the use of alcohol, but the advantages of the method are, that alcohol is always at hand, and the small amount of time necessary in washing. For these reasons it is the method of election in emergencies except in the operating room, and in the field. Setter's chiralpaste, of which much was expected because of its easy transportation, after trial by the Prussian War Department has been replaced by strong alcohol. In ordinary operative work, there is no risk attached to the use of alcohol provided the nails are thoroughly cleaned; however, those who do not have faith in this method may use with it hot water alcohol disinfection, of the Fürbinger method, although alcohol alone answers the same purpose.

The iodine-benzene method of Heusner has been varied many times for the reason that the pure mixture irritates the skin, so that to obviate the latter objection paraffin oil has been added and now the Heusner solution consists of iodine 0.5, benzene

800, and paraffin oil ad. 1000. The dilution of the iodine does not diminish its antiseptic properties; yet there is less irritation. Further, Heusner advocates immersion of the hands in concentrated alcohol for a short time in order to remove the brown color and prevent the slipperiness due to the paraffin. The field of operation should be sprayed with iodine collodium. Brümer and others report good clinical and bacteriological results after using this method, while Enderlein, on the contrary, finds it interferes with early wound healing. In order to offset the danger of benzene explosions, Grassman suggests the use of benzoformtetrachlorcarbon. Heusner states, however, that the latter substance is a strong skin irritant.

Von Herff and Kolle have obtained excellent results with tetrachlorethylene. Wallace recommends the use of dichlorethylene.

3. *Isolation of the Operative Field by Means of Impervious Materials.*—Rubber sheets were at first fastened to the incision surface, and the surrounding of the operative field after Murphy with rubber dam was attempted in this work. The experiment of Weil of pasting thin rubber sheets over the site of incision with iodine glue solution is noteworthy. Further experiments with Menge's disinfection of the hands with paraffin xylol, with Murphy's acetone-guttapercha, and with Schliech's wax were tried. These methods have as few followers as have the hand varnish of Lesai and Kossman's chirol. Haegler opposes these methods because of the permeability of the coverings over the irregularities of the skin. In addition to the above, the following methods have been described since 1906: Doederlein's guanidin, Wederhake's rubber skin, Dornitz and Klarpp's chirostes, Heusner's iodine collodium, Von Herffe's benzodamar, and V. Oettinger's mastisol. All of these materials have but few followers, except perhaps mastisol.

Upon a high pedestal stands the incomparable rubber glove, which, although not in so general use in aseptic work, is worn by all operators during septic operations. For the protection of the hands, in handling septic material, in dressing septic cases, and at the same time in not interfering with the healing processes, the use of the rubber glove cannot receive enough praise.

While the rubber glove is on a solid foundation as regards its use, the protection of the field of operation by sheet rubber has a better substitute in the use of tincture of iodine as recommended by Grossish, and this is the most important acquisition to the subject up to the present time, according to Küttner. Of course the use of tincture of iodine as an antiseptic in surgery dates back for a long time; Liebig having known of its surgical properties, and Pirogoff and Lücke having tested its germicidal powers. The original Grossish method consists in painting the field of operation twice with the tincture, regardless of other preparations.

The Grossish method has certainly lived up to expectations; 187 out of the 210 operators have used this method, and 89 have adopted it as their routine in all operative cases. The only objection to iodine for this purpose is the occasional production of an eczema which can be prevented by observing the following rules:

1. One can use a 5 per cent. instead of a 10 per cent. tincture (the ordinary strength). Küttner in 1400 operations found it gave the same satisfaction.

2. Frequently renewing the solution, as in old solutions iodine water forms, this being responsible for the eczema. Or the field of operation can be washed with alcohol, and then sprayed with the tincture, thus using nascent iodine *in situ*.

3. One hundred and thirteen of the 187 surgeons preceded the iodine treatment of the skin by other means, and of these 28 per cent. complained of the eczema, while of the remainder, who used the tincture without previous sterilization, only 8 per cent. noted the skin irritation.

The other details of the Grossish method are of little significance. The unanimous opinion of the operators of the advantages of this method are summed up by Müller as follows: (*a*) the benefits gained are out of proportion to the risks attached to its use; (*b*) it is applied in a few seconds; (*c*) it acts in a few moments; (*d*) it can be used in any operative procedure; (*e*) its action is absolutely positive; (*f*) the technic is so simple that any lay person can apply it; (*g*) it is not barbarous.

Küttner recommends the following technic: The evening before operation the patient is given a full bath, and the field of operation is shaved, no other especial attention being paid to it. New night- and bed-clothes are supplied. No dressing is applied to the shaved area. When the anæsthesia is started, one coat of 5 per cent. tincture of iodine is painted over the field of operation and a sterile dressing is applied. Just before the incision is made another painting of 5 per cent. tincture is made. In emergency operations the field is dry shaved and a painting of 5 per cent. tincture is made, this being repeated just before the operation is begun.

Küttner then sums up with the statement that the prevention of post-operative infection can be best accomplished by the use of tincture of iodine, alcohol, and rubber gloves.

II. INTRAVENOUS HEDONAL ANÆSTHESIA.

Dr. S. P. Federoff (St. Petersburg) submits the statistics of three Russian surgical clinics, namely those of Prof. Opel, Dr. Poljenow, and himself. Of 580 cases of hedonal intravenous narcosis, there was no fatality traceable to hedonal directly. Only in 8 cases was there respiratory failure with cyanosis, where artificial respiration was necessary. Lately, the author has had no such case, since he has regulated the flow of the infusion to 50–60 c.c. per minute. In no case was the cyanosis so deep as with chloroform.

The pulse becomes more rapid when the infusion is begun, but the quality is unimpaired. The blood-pressure is not changed. With hedonal one can obtain the deepest kind of anæsthesia.

The author recommends this method in nerve, gall-stone operations, in operative procedures about the head and neck, for, in these instances, it is better than inhalation anæsthesia. It is also indicated in cachectic and anæmic conditions.

III. INTRAVENOUS ETHER ANÆSTHESIA.

Dr. H. Kümmel (Hamburg) reports upon 90 cases of intravenous ether anæsthesia. The cases were selected with great care, and the nervous and circulatory systems and blood were examined thoroughly. This method can never replace scopolamine-morphine, ether, or chloroform, but he is convinced from a study of his results that in certain groups of conditions the intravenous method is invaluable.

The most important indications for the administration of the anæsthetic in the above-mentioned way is in operations about the face and head, especially of the mouth, trachea, upper jaw, base of the skull (hypophysis tumors), as well as of the neck. In these instances, the anæsthetist is out of the operator's way, and no mask is placed on the operative field. The quiet and equal anæsthesia, the freedom of the operative field, and the replacement of the blood lost by hemorrhage during the operation, by means of the salt solution, in which the ether is contained, are the greatest advantages of this method.

In nine cases of tumor of the upper jaw, larynx, thyroid gland, scalp, and base of the skull, in operations on tumors of the hypophysis and carcinoma of the tongue, as well as in rhinoplasty, it was surprisingly easy work because of the quiet anæsthesia and the uninterrupted field of operation.

There were also debilitated subjects, who through long illness were markedly emaciated and ill nourished, in whom a salt infusion was necessary before operation. Such patients under intravenous anæsthesia showed a marked improvement in the pulse and heart action, usually leaving the operating room in better condition than when they came into it. Return to consciousness is rapid; nausea and vomiting do not occur immediately after operation, and have not been noted, except in serious laparotomies, where, of course, it cannot be entirely prevented. The small amount of ether used accounts for the relative well-being of the patient following the anæsthetic. It acted in this way in 7 cases of cancer of the œsophagus and cardia, in 21 malignant tumors of the stomach, in 7 benign tumors of the pylorus, in 2 rectal and cæcal cancers, in 5 hysterectomies for carcinoma, in operations for extra-uterine pregnancies, and other benign and malignant tumors of the abdomen, in nephritics, in those with general peritonitis, and in patients with diseases of the joints and with bone tumors.

As several of the patients with cancer ended their sufferings sooner or later after operation, it was possible to control the clinical observations by means of histological examinations in 21 cases. The lungs, heart and kidneys showed no changes due to the narcosis, while in 11 cases there was a thrombus at the site of infusion. In those cases where Burkhardt's technic was followed to the letter with the interrupted instead of the continuous stream of infusion, were found large thrombi occluding the lumen of the vein. In later cases, no larger thrombus than after an ordinary salt infusion was noted.

In a later group of 50 cases, 10 controls were examined and in not one of these was a thrombus demonstrated. This he believes is due to an improvement in technic devised by Dr. Schmitz-Pfeiffer.

The danger of thrombus formation at the site of infusion, Dr. Kümmel thinks, is exaggerated. Since the universal use of salt solution as a vehicle for intravenous medication, although local thrombi form, pulmonary emboli never occur, an embolus from the upper extremity being rare. However, should thrombus formation be diminished or prevented entirely, it frees the method from any danger whatever.

Regarding the technic of the intravenous administration of the ether, all patients under 60 years of age receive 0.5 milligramme of scopolamine and 1 centigramme of morphine preceding narcosis. While unconscious, on the operating table, the eyes of the patient are covered, and under strict asepsis the median vein is exposed and a canula is introduced as in doing an ordinary saline intravenous infusion. In order to obviate thrombus formation, an attempt was made to preserve a continuous flow of fluid, while adding the ether mixture, in contradistinction to Burkhardt, who interrupts his stream, thus causing a thrombus to form. Taking advantage of the experiments of Schmitz-Pfeiffer, Dr. Kümmell attempted to attain his end by using two graduated glass tanks, one with physiologic salt solution, the other containing the other salt solution mixture. Two rubber tubes from these tanks connected with a Y-tube, to the simple arm of which was attached a third rubber tube and the canula, with a regulating mechanism controlling the primary tubes. By means of the latter adjustment an equal, easily regulated flow can be maintained. For example, should the narcosis be too deep, the flow from the ether mixture tank can be stopped, until the reflexes reappear, when it is again permitted to flow as indicated. Likewise, the salt solution supply can be regulated as necessary.

With this apparatus a permanent stream can be maintained, the amount of fluid injected can be noted at a glance, and the rate of flow easily regulated.

At the most after 10 minutes, or in very weak patients after 4 or 5 minutes, with an injection of 100–200 Gm. of fluid, equivalent to 4–5 Gm. of ether, the operation may be started. The rule is, that although one may get slight movements on the part of the patient at this time, they do not interfere with the operation.

During the early attempts, before the advent of the continuous stream, two cases of cyanosis and one of asphyxia were met with, the latter demanding artificial respiration. Perhaps these patients received too much ether, thus causing the undesirable complication. The cyanosis disappeared after the ether flow ceased.

The remaining anæsthesias were quiet, with regular respirations and pulse of good quality. No complications except the above-mentioned were noted.

The anæsthesia of longest duration was in an emaciated individual on whom a resection of 10 cm. of œsophagus and part of the stomach was done for carcinoma of the cardia. During a period of 145 minutes he received 1700 Gm. of ether mixture, containing 85 Gm. of ether. It is believed the survival of this patient was due to the method of narcosis. In another patient where a primary operation on the skull was done for a tumor of the base, 900 c.c. of ether mixture was administered with 45 Gm. of ether, over a period of 105 minutes.

The cases of intravenous ether anæsthesia did so well that the use of isopral and hedonal, with which Burkhardt and Federoff have obtained such good results, has been discarded.

Intravenous ether anæsthesia according to Dr. Kümmell's experiences is a form of narcosis indicated, in a certain group of cases, that at the present time cannot be duplicated. He would use this method as the ideal anæsthetic in many operations.

IV. LOCAL ANÆSTHESIA IN OPERATIONS ON THE TRIGEMINUS.

Dr. H. Braun (Zwickan) reports his experiences in interrupting the conductivity of the fifth nerve. This is accomplished by injecting a 1 per cent. solution of novocaine-suprarenin. The first division is reached by deep injection through the orbit, the second by introducing the needle into the pterygopalatine fossa. The most simple way to reach the third division is at the junction of the lingual and inferior dental nerves, as described by the author in his Handbuch. In addition, the external site of operation must also be anæsthetized, for example in resection of the upper jaw the line of incision must be injected. For this purpose an 0.5 per cent. solution is used. Under local anæsthesia the following operations were done: 13 radical operations for frontal sinus disease; removal of the nasal bones for carcinoma; removal of nasal fibromata with flapping over of the superior maxilla by Kocher's method; 8 resections of the upper jaw, 12 removals of the tongue for cancer; removal of the floor of the mouth and tonsils, some with preliminary splitting of the inferior maxilla. In the main operations thorough removal of the lymph-nodes was also successfully accomplished under local anæsthesia.

The advantages for this method apparently are in this location of the body rather than in other parts. Not only is complete anæsthesia obtained, but the field of operation is practically bloodless. For resection of the superior maxilla, ligature of the carotid, as recommended by Kuhn, is unnecessary, as there is no bleeding. Lung complications are rare. For resection of the inferior maxilla and for operations on carcinoma of the mouth and nose, this statement also holds true.

V. FREE TRANSPLANTATIONS.

Dr. Lexer (Jena) reports that for forty years, since Reverdin's report, German surgeons have attempted to successfully transplant tissues. Epidermis unites well, as is well known, in skin grafting; mucous membrane not so well, as in defects; and certain tissues within the body not at all, as in dural defects. Skin flaps with or without fat, regardless of size or shape, can be easily transplanted anywhere. Only within the body, such tissues as the peritoneum, pleura, or synovial membranes will not unite. The blood supply is the important factor. The best way is to allow the part to bleed until clots form, and the donated tissue is pressed on these, the fibrin acting as a fastening substance. Heteroplasty is not practical. Regarding homoplasty, the reports in the literature vary. Lexer's conclusion is that only a transitory result is obtained by the use of fetal tissue in transplantation. Foreign epidermis or skin flaps either become gangrenous or apparently take, only to be discarded in three weeks by suppuration and granulation. The scar is like one after crust healing, even when the foreign tissue is cast off without pus formation. Finally, the apparently healed epidermis desquamates and is replaced by a scar. The epidermis grafts of a fœtus apparently attach and heal, only to disappear later.

Racial differences were also observed. While the grafts in like races healed with scar formation, those of different races desquamated with pus production. Homoplastic transplantation in blood relatives was not attended with brilliant results.

Homoplastic transplantation of mucous membrane was not successful; while in grafting mucous membrane of the one individual (autoplasty) infection occurred. Transplantation of the appendix to the urethra for defects of the latter was attended with excellent results when the peritoneum of the former was first removed. Attempts to replace portions of the œsophagus with resected intestine were unsuccessful.

Fat transplantation in autoplasty has been attended with good results, to prevent adhesions between the dura and the cranium, to fill out sunken defects on the face, about the joints and breast, to fill out the orbits, and in the repair of nerves and tendons.

Muscle and nerve autoplasty give poor results. Future investigations may reveal some advantage to be gained by nerve autoplasty in hastening nerve regeneration.

Blood-vessel transplantation has been made possible by the blood-vessel suture. The earliest attempt in man was reported by Lexer four years ago. In this case a portion of the saphenous vein was inserted for an arterial defect; the result is still good. Homoplasty of blood-vessels, it is true, is attended with good results, but only by substituting vessels from the same locality; yet it does not give the same success as does autoplasty, because of thrombus formation. Apart from repairing the circulatory apparatus, blood-vessels can be employed to repair defects of the urethra. Attempts to use them in plastic operations on the ureters were not successful because of the constant flow of urine. For nerve injury, autoplasty does very well, by using the vein, but not as well in tendons.

Fascia and periosteum transplantation has not been successful.

In general transplantation of tendons the success depends entirely upon early exercise. With complete immobilization adhesive bands form. With early motion the bands do not form, and the functional stimulus aids in the regeneration of the weakened tissues. On this ground, the repair of tendons and tendon defects is possible, for example, after suppurative destruction of the tendons of the fingers. In these cases small incisions are made under the skin and portions of the palmaris longus tendon from the same patient are transplanted. Homoplastic transplantations of not too thick tendons are just as feasible. These methods are established clinically and experimentally.

Peritoneum in the form of hernial sacs and hydrocele membrane has been employed to repair dural defects, with ill results, as thickening and adhesions occurred. Normal peritoneum and omentum acted in a like manner.

General bone transplantation has given brilliant results, especially when the specimen was obtained with great care from freshly amputated limbs and from the corpse. The cartilage with the bone retains its vitality without showing any changes in its growth experimentally.

Homoplastic transplantation of cartilage alone to repair sunken defects of the face or for insertion between joint surfaces, as well as the transfer of ear muscles and joint cartilage, is possible.

The transplantation of joints *en masse* from amputated limbs or from the cadaver gives good results. In so-called half joint transplantation, *i.e.*, when one articular surface of a joint with the muscles and tendon is transplanted, one can attain good function. In complete joint transplantation, Lexer reports a splendid outcome in a case operated three and a half years ago, but one must be careful of the material used, as atrophy of all the tissues is apt to occur. In another case a knee-joint obtained 8 hours after death was transplanted, and 5 months later the wound was absolutely healed.

The outlook in transplantation of entire extremities is not very favorable, as, though technically the method is practicable, one has ischæmic muscle contractions to contend with.

In visceral transplantation, the consideration is purely one of homoplasty. The outlook is poor. Clinically, the ductless glands seem to give some results, but their gradual disappearance through resorption is the rule, experimentally. To transplant entire organs with their vessels, unfortunately can only be accomplished by autoplasty. In homoplasty of viscera it is a question of nutrition, and possibly a biochemical difference of cell proteid and serum that prohibits success.

VI. EXPERIMENTAL INVESTIGATIONS IN BRIDGING DEFECTS OF ORGANS LINED WITH MUCOUS MEMBRANE.

F. Hehmeier (Greifswald) reported experiments done on dogs to repair defects of the trachea by means of foreign fascial flaps. Large and small defects of the anterior wall of the trachea were recovered with fascial flaps obtained from the sternocleidomastoid and anterior rectus muscle sheaths. The borders of the flaps were placed upon uninjured tracheal tissue, then fastened at the four corners to the trachea, and sewed to it by a continuous suture. For further stability their borders were sewed to the perichondrium and cartilage. The flaps then lay in place smoothly. The muscles and skin of the neck were united and drainage was not instituted. In two cases healing with perfect union was noted on from the eighth to the tenth days. In young dogs, with tracheæ the consistence of those of children, the lumina of the tracheæ were not contracted. In 8 out of 9 cases the result was brilliant. Two of the dogs coughed for several days, severe pulmonary complications did not occur, and skin emphysema was not observed. The dogs were killed after 2, 3, 6 and 12 days. In three cases there were adhesions of the flap to the subcutaneous tissues. The flaps in the remaining cases were free and not contracted, the surfaces bridging the defect being very smooth; blood-vessels entering the new tissue from the perichondrium could be plainly observed. On the inner surface, in three cases there were small granulations, while the rest were covered with mucous membrane. Microscopical examination showed that the nutrition of the flaps was derived mainly from the perichondrium. The epithelial lining was somewhat flatter than the normal.

Defects of the urinary bladder were treated by transplanting fascia of the anterior sheath of the rectus muscle or portions of the fascia lata. The bladder was exposed by a laparotomy and areas of varying size from a quarter to one dollar were covered; in one case the anterior wall was entirely replaced. The defects were covered with either single or double layers of fascia, and a double layer of sutures was inserted. The bladder was returned to the abdominal cavity and the wound was closed. In four out of five cases the outcome was very satisfactory.

Whether larger bladder defects can be remedied in this way is a subject for further study; but tracheoplasty, from the results obtained in animal experimentation, is worth while trying in man.

HEAD, NECK, AND THORAX.

I. ON THE PROPHYLAXIS OF POST-OPERATIVE MENINGITIS.

H. Leischner and W. Denk (Vienna) reported a series of investigations in which the bactericidal property of urotropin in preventing infection after brain operations was tested. It is well known that urotropin in ordinary dosage appears in the cerebrospinal fluid as formaldehyde in small quantities. The above authors wished to ascertain whether urotropin really appears in the cerebrospinal fluid, in what concentration and what types of infection it is able to overcome.

After administration of 2–8 Gm. of urotropin per os, within a few days Dr. Jantsch demonstrated 0.004–0.02 per cent. of free formalin in the cerebrospinal fluid. Experiments were then undertaken with solutions of varying strengths of formalin (including the above percentages), and it was found that their germicidal powers were relatively weak, as even dilute emulsions of bacteria when acted upon still remained alive.

They conclude that in mild infections this drug may be of some aid, but in the severe types it is utterly useless.

II. FURTHER EXPERIENCES IN PUNCTURE OF THE CORPUS CALLOSUM.

Von Bramann (Halle a. Saale) reported as follows: The technic of the puncture of the corpus callosum is the same as that described by the author two years ago, except that the operation is done in adults and in children who do not get a general narcosis, under local anæsthesia by means of novocaine and adrenalin. The injections into the soft parts and under the periosteum render these tissues, as well as the bone and dura, anæsthetic. An incision 3 cm. in length, about the width of the index-finger, behind the coronal in the midline divides the soft parts down to the bone. After reflecting the periosteum, the skull is trephined about 1.5 cm. from the midline, an opening 1.5 by 1 cm. being made, and the dura is exposed. The latter is then incised (for 2–3 mm.) in a location free from veins, and a silver canula is carefully introduced between the dura and pia mater until the falx cerebri is reached. The diameter of the instrument should be about 2–3 mm. The course of the canula is carefully directed to the corpus callosum, moving it from side to side, in order to avoid the distended sinuses and veins. The corpus is then cautiously punctured and after a fair amount of fluid (15–20 Gm.) escapes, the opening is gradually enlarged by moving the canula to and fro. The tube is now removed, the dura and soft parts are sutured.

Certain complications were met with because of processes of sinus and also because of the dilatation of veins due to the increased intracranial pressure. In some of these cases, packing of the wound was necessary for several days. No large vessels were encountered in the deeper parts of the brain. In 51 cases there was no fatality. Operated upon were 27 tumors of the brain, 18 cases of hydrocephalus, and 6 epileptics. In the first group of cases, the general tumor symptoms—headache, vertigo and vomiting—disappeared or became less severe. The first symptom to vanish in many cases was the choked disc. In less than one-half, no change in the eye grounds was observed. However, the tumors in the latter cases were situated in the large basal ganglia, where compression of the blood-vessels was very great.

Two of the hydrocephalus cases were entirely cured. In some instances the tumor could be located by means of the canula, as when situated in the wall of the ventricle.

The author recommends puncture of the corpus callosum in all cases of hydrocephalus in children and in all cases of acute hydrocephalus in adults, as their symptoms are always relieved. The former are always favorably influenced, the choked disc in half the cases being relieved, and in the remainder permanently cured.

The operation is indicated in all cases of brain disease where there is congestion of the optic vessels and blindness is present.

III. BASEDOW'S DISEASE.

Prof. Dr. Theodore Kocher (Bern) after analyzing 721 operations on the thyroid gland, in 535 patients, concludes that as a result of the histological changes which have been noticed, there has developed an over-secretion in which the iodine content is much increased. The symptom complex of Basedow's disease can be produced in animals through the injection of the secretion of the gland, the gland substance itself, or iodothyroidine, from which experiments the conclusions were made that the disease was the resultant of a hyperactivity of the thyroid. In confirmation of this conclusion it is stated that as a rule the exhibition of iodine therapy in these cases usually causes an intensification of the condition. Further research disclosed the fact that a leucopænia exists in this class of patients, with a relative increase in the mononuclear cells, and further that the processes of assimilation were markedly diminished.

The clinical picture presents at times a predominance of symptoms involving the sympathetic system, at others, those more relevant to the vagus. Thus one is evidenced by the exophthalmos, tachycardia, or glycosuria, in the other class disturbance of the alimentary tract takes precedence.

Of etiological import, spells of temper, iodine therapy in diseases of the thyroid, infectious diseases, and hypersecretion of the generative organs seem to precede the onset in the majority of cases.

If the disease is due to a hyperactivity of the thyroid, the aim must be to diminish by operative removal the amount of the gland which is secreting. This has been accomplished by the author, and he has established the fact that the degree to which health may be restored is proportional to the amount of gland removed. In his own experience the operation has been found to be accompanied with very little danger, 3.1 per cent. mortality in 535 patients, and he concludes therefore that the disease should be surgically treated, and operative intervention should be undertaken at the earliest possible moment.

IV. EXPERIMENTAL RESEARCH IN BASEDOW'S DISEASE.

Heinrich Klose (Frankfort am Main) endeavored to determine whether the disease of the thyroid gland described by Basedow was due to a hyper- or a hypo-activity of the parenchyma. The work was done at the Institute for Experimental Surgery in Frankfort am Main.

It was demonstrated in dogs that subsequent to an injection of a freshly prepared extract from the gland of a patient with Basedow's disease, a typical picture of this condition was reproduced. The dogs even after small amounts of injected material developed fever and irregular pulse, panting respiration, chills, sweating, and albumin and sugar in the urine. Very infrequently an exophthalmos was noticed.

The blood picture after a very transient diminution of the polynuclear cells developed the typical hyperthyroid lymphocytosis. The blood-pressure diminished from 200 mm.Hg. to 80 mm.Hg. After eight days at the latest the severity of the reaction had disappeared. The reaction is so delicate that it forms an important point in the differential diagnosis between those cases in whom the clinical picture is not sharply cut and in whom it is a question as to whether one has to deal with an instance of Basedow's disease or an ordinary goitre.

If one injects a dog with a large amount of an ordinary goitre, there appears merely an atypical blood reaction, which is the result of the foreign albumin, and there follows no clinical disturbance. Klose then injected animals intravenously with potassium iodide in order to more certainly identify the nature of the toxic substances in these cases, employing 0.03 pro kilo body weight. The animals reacted identically as in the experiments where the extract of the previously diseased gland was injected. Therefore the results in the latter must have been due to the iodine content alone.

The author concludes from his experiments that: (1) Basedow's disease and the hypothetical hyperthyroidism are mere qualitative differentiations. (2) The toxic effects in Basedow's disease and iodine poisoning are probably identical. In accordance with Klose's working hypothesis there exists in cases of Basedow's disease a portion of the glands in which the specific properties are lost, namely, to secrete iodine in an organic form. It is quite possibly poured out directly as inorganic iodine or more probably deposited in some corresponding form which is easily transformed into an inorganic substance in the body. The body must withstand the continued action of inorganic iodine, which results in a symptom complex known as Basedow's disease, in which are evidenced many of the phenomena of iodine poisoning. Klose's theory is in accordance with the experiences at the bedside. Further, also, with the latest physiological researches in which iodothyroidine was administered, not as iodine proper but in a form of inorganic iodine by which an artificial Basedow's disease was established.

From these observations, Klose concludes that Basedow's disease is a dysthyreosis and not a hyperthyreosis. That the dysthyreosis results in the gland not being able to exert its inherent property to secrete iodine in the usual form of iodothyrin, but secretes an entirely distinct form, which in the present state of our knowledge may be termed " Basedow's iodine," which releases very easily an inorganic form of iodine, which acts in the same manner as an intravenous injection of inorganic iodine.

PROF. W. GARRÈ (Bonn), in discussing the two preceding papers, stated that in cases of Basedow's disease the thymus must be taken into operative consideration, as in those with very severe manifestations and in those who have died there has been found almost without exception a persistent thymus. In one severe case of Basedow's disease a thymectomy, without interfering with the thyroid at all, resulted in a marked improvement of the condition of the heart, a complete disappearance of the so-called Kocher's blood picture, and a very appreciable increase in weight. In a second case in which a partial thyroidectomy was done at the same time, a similar improvement was noted. Dr. Capelle has already published the conclusions that the hyperplastic thymus markedly increases the degree of symptoms evidenced in this class of goitres, and there seems to be no question that a selective heart toxin is elaborated by the thymus as pointed out by Klose.

The speaker in considering the differential diagnosis between thymus and thyroid as the etiologic factor, mentioned the following significant observations:

1. The blood picture described by Kocher disappears after thymectomy as well as after thyroidectomy.

2. Dr. Bayer, his assistant, had been able to produce in dogs after injection of so-called "Basedow-thymus extract," the typical blood picture as described by Kocher.

3. Subsequent to thymectomy in this class of cases, a marked absorption of the concomitantly enlarged thyroid has been observed (Capelle and Bayer).

4. Thymus implantation inhibits the onset of cachexia strumipriva (Gebele).

5. Implantation of thymus removed from a patient suffering from Basedow's disease into a dog caused the development of a Basedow's symptomatology of the severest kind.

Garrè believes that there is a class of patients suffering from this disease which must be separated from the remainder, owing to the combination of a persistent thymus with the usual goitre, which are recognizable by the exceptional severity of their symptoms.

This conclusion received further confirmation from his own clinical experience, namely in 65 operations on cases of Basedow's disease there occurred but two fatalities—both showed a persistent thymus.

In looking up the records of the end results obtained in those cases where a partial thyroidectomy was done, all of which were treated with the same therapeutic measures, he found a mortality of 10–15 per cent. (all suffering from extreme tachycardia and exophthalmos), and he believes that the explanation in these cases of their unfavorable termination may be found in the occurrence of a persistent thymus, and remarked in conclusion that further experience must be obtained before one may judge whether this class of cases should be recommended for operative interference or not.

Dr. J. Dollinger (Budapest) said that severe cases of exophthalmos are rarely seen in Basedow's disease; but when present they are accompanied by severe headache, pain in the eyes, chemosis, swelling and ulceration of the cornea, swelling, perforation, and destruction of the bulb. Sattier cites 63 cases of which 12 ended fatally. Hoor reports two cases, one of which died after losing the sight in both eyes, and one remained alive after losing the sight of one eye. V. Poppen reports briefly a similar case. The therapy was confined to compresses and canthorrhaphy. As the exophthalmos progressed, necrosis was accelerated. In the fall of this year a man aged 63 years came into the clinic suffering with bilateral exophthalmos, chemosis, swelling of the left cornea, severe headache, and pain in the eyes. He was operated on Oct. 20, 1910. The temporal regions were exposed, part of the bone removed, the periosteum extirpated, exposing the contents of the orbit through the incision, through which the exophthalmos forced itself. It was thus dislocated laterally, and canthorrhaphy was performed. The corneal swellings, chemosis, headache, and eye pains were relieved. It is to be regretted that the muscles in the region of the temple were not united, as suppuration in the orbit may not have occurred. The skin healed *per primam.*

Dollinger saw this patient five months later. The bilateral exophthalmos was less marked, the corneal swelling of the left eye was covered with a smooth scar, the headache and eye pains had not returned.

Dollinger recommends this operation in severe exophthalmos Basedowii as soon as headaches and eye pains (severe) or chemosis appear. These cases should be relieved if possible before the advent of corneal swelling. If it is done early it can be followed by canthorrhaphy.

Dr. Hildebrand (Berlin) called attention to the importance of a very thorough investigation of the condition of the heart, basing his remarks on a series of 100 operations undertaken by him for the relief of Basedow's disease with a 5 per cent. mortality, some of which he attributed beyond question to an insufficiency of the heart muscle after operation. In many instances the indications for operation and the prognosis were based on the condition of the heart. As an important aid to such investigation, the speaker recommended the employment of the electrocardiogram, through the use of which a satisfactory record of the condition of the musculature of the heart may be obtained before operation, and subsequent proof afforded of the improvement in its condition after operation by comparing the curves obtained.

Freiherr V. Eiselsberg (Wien) regards operation in this class of cases as always more dangerous than in those for simple goitre, and emphasizes the point that one should not overlook the fact that a small per cent. of cases of Basedow's disease die anyhow after having suffered greatly for a long time. This is particularly true of those poor patients who are unable from social reasons to afford a requisite period of time for convalescence. The operation is particularly dangerous in cases of severe myocardial degeneration with a pulse frequency in the neighborhood of 140. A persistent thymus, which condition can be diagnosed through our present methods of investigation, is not to be regarded as a contraindication to operation. In the speaker's personal experience there were four instances in whom unmistakable evidences of a persistent thymus were present and on whom an operation was performed with very great improvement. He had had only six deaths in operating on 71 cases of Basedow's disease during the last ten years. Three of these fatalities occurred among the first six operated on, all of whom had a pulse-rate of 160 or over. In four of the cases, the existence of a thymus gland was demonstrated, one showed a very marked myocarditis, and the sixth died of pneumonia. One case suffered from apoplexy, having had a lighter attack previously. With the exception of two others on whom a hemithyroidectomy was done without any betterment of their condition, the results have been uniformly encouraging, especially as regards the suffering. The exophthalmos was not noticeably influenced.

In 59 cases half the gland was removed. In 7, both sides were resected. In 3 instances ligature alone was primarily used and later a partial thyroidectomy done. There were no operations performed on the sympathetic system. Most of the cases were done under local anæsthesia following preliminary injection of morphine and scopolamine. Lately ether has been employed.

In conclusion the speaker said that the operation should not only be undertaken because of the pressure symptoms, but may also be performed from social reasons, since thus far the results have been so favorable. The danger while naturally present is not so real that operation may not be undertaken even in the most advanced cases, as by operation alone can the patients be relieved of their terrible suffering.

DR. KÜTTNER (Breslau), in continuing the discussion, stated that it was especially important to study the remote results of operation in cases of Basedow's disease, and not consider the immediate results so vitally, and from statistics determine which case should or should not be operated on. To determine what such statistics would show, Dr. Baruch, under the direction of the speaker, had collected the material which offered itself at the Breslau clinic during the last eighteen years.

There were 85 well-marked cases of this condition found, those lately operated having been omitted. Of these 85, 21 were treated conservatively. These occurred necessarily during the earlier years, at which time the technic of operative interference had not been developed; some, however, during the latter years in whom the conditions were especially desperate. Two of these cases died in the ambulatorium while awaiting treatment. Three others died later from cardiac failure. Of the remaining 16 non-operated cases, the speaker has been able to trace 9, in whom treatment had been instituted as long as 15 years. None of these patients has recovered health. One case only which was of mild severity seemed to have in any way improved, but is by no means well. All the remaining cases continue to suffer as previously, or have become worse. All are unable to work except the one case just mentioned.

Of the 63 upon whom various operations were performed, 11 died post-operative. These were all instances in which the disease was very far advanced, and in whom operation was undertaken as being the only possibility of saving a life otherwise surely lost. Two died from pneumonia, two from a persistent thymus, and the remaining seven because of cardiac insufficiency. In this series of fatalities all four arteries were ligated in two. In one a bilateral resection. In the remainder, a partial thyroidectomy was done.

Of the 53 patients that survived, subsequent information has been obtained concerning 37 of them; 31 have been personally re-examined by the speaker. One patient died six years after the operation from an intercurrent illness. The remainder are still alive, the longest being eighteen years post-operative.

Of greatest interest are the 15 severe cases who were operated and in whom, beyond question, if conservative treatment had been advised, would have surely died. Of these five or one-third recovered, and to such a degree that all subjective and objective symptoms of Basedow's disease have disappeared. Eight others were so greatly improved that they were able to resume their occupations, and in only two instances of an extremely severe type was there no betterment in the condition. One of these was a resection; the other, treated by ligature of three arteries.

If we consider all the patients traced without relation to the severity of the disease we find 33.2 per cent. recovered. By that is meant that no symptoms of Basedow's disease are to be found. In other words, the patient is entirely well. Thirty-six per cent. showed a very marked improvement. By this is meant that they are able to resume their occupations, and differ from those considered entirely recovered only in the fact that there still persist some of the less important features of the disease. The third class constitutes 16.6 per cent. of the total, and represents those, who although able to work, have still some of the more serious symptoms present. These the speaker considers as merely improved. In only five patients was there no betterment in their condition. Of these two had incomplete operations.

In contradistinction to those conservatively treated, 35.7 per cent. have died, and of those still alive there has been in no instance a return to health. One only is able to work. Of those operated on, 17.3 per cent. died. Of those still living, 13.8 per cent. have not recovered health. The remaining 86.2 per cent. have either entirely recovered or are able to do their work.

This indicates that the so-called "morbus Basedowii" is a surgical disease. Its best therapy is early operation, by which the fatalities from this condition are rapidly becoming less and less.

In 24 operated cases blood analyses were made in order to establish the presence of Kocher's lymphocytosis and the regenerative processes in the blood some time after operation. The results from these investigations appear, however, to be of little value. It is interesting, however, to notice that a condition of lymphocytosis may persist in some patients who have entirely recovered from all clinical manifestations of Basedow's disease. Possibly the etiological factor in these cases may be found in the persistency of a thymus gland.

V. WOUNDS OF THE HEART.

FREDERICH HESSE (Dresden) had had the opportunity in Würzburg and Stettin of seeing ten cases of wounds of the heart operated upon; six of them had been conducted by himself.

One case, a gun-shot wound of the left ventricle, occurred in a boy of fifteen. At operation the heart was found stopped in diastole, massage was without result. Camphor injected directly into the heart musculature succeeded in re-establishing its contractions. The patient lived for seven hours after operation. The remaining five cases were stab wounds, two in the left and one in the right ventricle, and two in the left auricle, which were operated on in 1905, 1908, and 1909, and recovered. These were personally examined during March and April, 1911, and were demonstrated before the Society.

In four cases the pleura was widely opened during the operation, and in three of them the pericardial sac and pleural cavity were drained primarily, the latter being effected by means of a rib resection posterior below the apex of the scapula. In the other case the wound was closed at the time of operation without drainage. Three days later the onset of a bronchopneumonia and a beginning pleuritis necessitated resection of a rib and pleural drainage below the scapula. The four patients are pursuing their usual vocations, and have no subjective complaints. Objectively are to be noticed a decrease of the normal respiratory movement on the left side and corresponding to the point of previous infection, under the ribs and sternum anterior the pulsation of the heart is very plainly discernible, the soft parts rising and falling with each movement. In one of the cases, there is unquestionably an adhesive pericarditis which attaches the heart directly to the overlying soft parts. There has in none of them been any change in the pulse. The border of the heart is somewhat further to the right than normal. Nothing is gained from auscultation.

In the fifth case the operation resulted in diffuse adhesions between the left lung and the parietal pleura, and also with the pleura surrounding the pericardium, which obviated the collapse of the lung or any pneumothorax. There was in this instance complete primary closure of the wound, without drainage, and a smooth, rapid convalescence. But this patient is not yet able to resume his work (two and a half years post-operative), and complains of frequent attacks of stabbing pains in the cardiac region. Objectively there is no recession, and the lung findings are the same on both sides. Between the fifth and sixth rib, however, there is a very distinct systolic murmur for a space of 4 cm. inside of the mammillary line—there was no resection of the rib done.

The following conclusions were drawn by the speaker:

1. That no delay should be counselled before operating even in those cases where one may not be sure that the heart was wounded.

2. That the administration of stimulants before termination of the operation should be omitted. Do not give morphine before the operation, but it may be administered with benefit in the after-treatment.

3. There are several methods of incision. A good one which may be easily extended and which eventually affords convenient drainage of the pericardial sac, is that described by Kocher. Rehm's ⊢ shaped incision, which forms two flaps with a lateral base, gives a good approach in those cases where a partial resection of the sternum may be necessary. In cases where the diagnosis of a wound of the heart is certain, it is advisable to approach extrapleurally, and eventually, without considering the situation of the external stitches, the hæmatothorax can be evacuated by means of a puncture.

4. Regarding the question of drainage, the writer recommends that in those operations where the pleural cavity has been widely exposed or exposed for a long time, an absorbing or capillary drain should be introduced, which should be placed at the lowest point, best to the left posterior and below the scapula. Any possible infection must be anticipated by a prophylactic drain-

age, the principles of which need careful consideration, and a wrongly placed drain may cause direful consequences. The main points pointing to the regular employment of pleural drainage are: (*a*) By a wide opening of the pleural cavity there is established an artificial bellows. In this operation, therefore, in contradistinction to others, we have no control over air infection and the field is continually in motion. (*b*) Also in the manipulation of the operative pleural wound and in the evacuation of the hæmatothorax there is necessarily a good deal of direct trauma, which predisposes almost without exception to an exudate which forms an excellent culture media for the growth of bacteria.

5. In the recovered cases there is no inconvenience suffered from the lack of a bony framework resulting from the defect in the ribs in front of the heart.

VI. DECOMPRESSION OF THE THORAX.

Dr. Klapp (Berlin) first spoke of the means of preventing the regeneration of the ribs after rib resection by the subperiosteal method. The periosteal tube is fairly safe as the new bone is concealed; but the danger is that the smooth pleura and lung may be injured. Two cases were accompanied by pleurisy with effusion and pneumonia. Instead of the thermocautery, which causes injury through heat, fuming nitrous acid may be used. A porous stick of wood is dipped into the acid, and then lightly applied to the periosteum.

In order to mobilize the thorax by rib resection, disturbance of the periosteum alone does not suffice; functional mobilization is necessary after operative mobilization. By means of the latter only, can the patient obtain benefit from his previously operatively mobilized thorax. Great stress must be laid on the after-treatment. If the thorax is neglected, there follows contraction of the chest walls due to the elasticity of the surrounding skin, to the contractile muscles and to the elasticity of the lung itself.

That one can overcome this condition after resection of the rib has been demonstrated in a case by Wilms. That the contraction follows very soon after operation was shown in a case, where, three weeks after the resection, there resulted absolute rigidity of the thorax. Because of an ankylosis of the spine and a bilateral resection of six ribs, mobilization of the thorax was impossible. In the short time of three weeks the space of 5 cm.

contracted to one of 1 cm. The cause was not due to new bone formation.

To accomplish decompression, in addition to mobilization, it is necessary not only to remove a small portion of the rib, but the whole rib or a series of ribs. Decompression operations have been rarely done, but surgery will find a fruitful field for them.

Klapp then demonstrated a patient with asthma and a very deformed rhachitic chest. This is the second such case ever operated on. In the Hirschberg case (the first reported), a regeneration of ribs took place, while in this one it did not. The result of the operation is not a total cure, but a partial amelioration of the asthmatic symptoms. Combinations of asthma and deformed thoraces are not rare. Beckart reports 180 cases.

In addition to compression of the thoracic viscera by chest deformities, the abdominal organs, as the kidneys, stomach, liver, and spleen, may be compressed.

Klapp reports some cases of decompression of the kidney on account of deformed thoraces. In one case there existed pain in the kidney due to compression by a scoliotic spine, in two cases stone in a compressed kidney, in one case albumin in the urine, which disappeared immediately after operation. Because of the difficulty in passing a ureteral catheter, it was not determined from which kidney the albumin originated, but the assumption is that it came from the compressed one.

In severe cases, where organs give symptoms of compression, Klapp recommends the possibility of treatment and a trial of decompression.

ABDOMEN.

I. TREATMENT OF INTESTINAL PARESIS BY HORMONAL.

Dr. Henle (Dortmund) said that the nature of hormonal and the method of obtaining it was described in the *Zentralblatt für Chirurgie*, 1910, No. 42. It is prepared, sterilized, and admixed with eucaine for intramuscular administration, and without the local anæsthetic for intravenous injection. The speaker, however, does not consider the addition of eucaine necessary and has omitted it in his work.

Through animal experimentation, without considering the experiences at the bedside, it has been demonstrated that hormonal is superior to physostigmine in its action. The physiological research showed conclusively that peristalsis was stimulated in a regular continuous manner, beginning at the duodenum and continuing to the large intestine, pushing the bowel contents before it until they were ejected from the anus. As the result of injecting physostigmine, on the other hand, there occurred merely temporary and irregular contractions, with, at times, a persistent spasm which did not tend to push the intestinal contents forward.

Henle, in further investigation with this substance, demonstrated the great benefit which occurred from its use, when given post-operative in instances of paresis which had not originated as a result of peritonitic inflammation.

In addition to a case already reported of paresis consequent to removal of a gall-stone, the speaker has employed this therapeutic agent in six other cases, in which the same conditions presented and in all of which the results of the administration of hormonal were most gratifying. In these patients thus treated there occurred in from one to five hours after the injection marked peristaltic movements within the abdomen, resulting in each instance in a rapid evacuation of flatus *per ano* and a consequent relief of the meteorismus with an immediate and permanent betterment of the general condition. One other patient suffering from a milder grade of intestinal paresis was also treated thus with favorable results.

In each instance it was necessary to give only one injection of from 15 to 20 c.c. of hormonal, in order to stimulate the peristalsis sufficiently to cause the passage of flatus. In order to stop the continuous action of the intestines, it is necessary to wash out the lower bowel with enemas and to administer appropriate medication by mouth.

In the treatment of chronic constipation, many observations have been made by internists, which would indicate that its action may continue for a long time, weeks and months in some instances. This statement does not hold true for those acute cases thus treated resulting from operative interference. If the cause of the paresis is not removed the action of the hormonal continues in its efficiency.

In many cases because of the above indicated continuance of action, it is necessary or advisable to employ other measures for relieving the condition. In others it is necessary to repeat the injection. Thus in some instances where there is present a diffuse peritonitis which has caused an absolute paralysis, it is possible, after the administration of hormonal, to so markedly influence the bowel action that the gas and even fæces themselves will be passed. Indeed in these cases it will very probably be advisable to reinject hormonal after an appropriate interval in order to bring the case to a successful conclusion. The septic process *per se* will be in no way influenced. One instance was cited in which the patient's life was obviously saved, in which the infection itself was treated by other measures.

Also in cases where adhesions are present or in order to prevent their recurrence after operation, this substance can be employed with benefit, as thereby the bowels are kept continually in motion. Further it is indicated where morphine has been administered either during or immediately after operation, or in those cases where it has been used to induce narcosis. Pantopon was suggested as an addition to the morphine injection and thus overcome the paralytic effects of the drug.

The by-effects of injecting hormonal, as a rise in temperature, chills, or a harmful influence on the general condition of the patient, are not very evident and are so evanescent that they may be disregarded and should certainly not be allowed to weigh against the administration of the preparation. One can also with an easy mind in many cases very gradually increase the dosage as indicated and thus use the preparation during a long period of time.

II. THE TECHNIC OF PYLORIC EXCLUSION.

Dr. Ch. Girard (Genf) said that gastro-enterostomy, especially as a substitute for a radical operation, is without combination with a direct pylorus exclusion, especially in cases of pyloric and duodenal ulcers, in many instances incomplete. If the experience with pylorus exclusion as performed by V. Eiselsberg is unsuccessful, the speaker recommends the employment of an easy and rapid plastic method of extramucous stenosing of the parapyloric region.

In order to accomplish this the Mikulicz-Heineke principle of pyloroplasty is reversed. The separation of the seromuscular layers is done without difficulty, and the Längs suture introduced.

In greatly exhausted patients the reader was accustomed to use a plicature of the anterior wall of the stomach or a prepyloric ligature as indicated by Körte. A few cases so treated complained for the first few days post-operative of severe pain.

Under favorable conditions in a case of callous ulcer of the fundus of the stomach, and especially those situated on the lesser curvature, Girard combines the gastro-enterostomy with an artificial median gastric stenosis,—that is to say, an artificial hourglass stomach is made and thus the disease focus short-circuited from the alimentary canal. A favorable result may be anticipated. Two cases were mentioned to support this statement, in which such a partial exclusion of the stomach had been done by means of several plications of the anterior wall. The first was a case of a patient greatly debilitated by hemorrhage, who died from pneumonia three weeks post-operative, although the function of the stomach had been re-established. The necropsy demonstrated that the artificial stenosis had held perfectly. In the second case the result was perfect throughout.

The reader further remarked that the use of an extramucosal plastic operation, as previously indicated in exclusion of the pylorus, might be used to great advantage in such cases, but as yet he had had no opportunity to employ it.

Drs. Kirchner and Mangold (Königsberg), in discussing the foregoing paper, stated that if the vagus was either irritated or severed at any situation between the base of the skull and its perforation of the diaphragm, it occasioned various phenomena relevant to the motility of the stomach. That in doing a transverse resection of the stomach, the terminal filaments of the vagus which spread out over it are severed, and that there must follow therefore a functional disturbance of the distal segment of the organ, especially in the antrum and pyloric sphincter. This, they were able to demonstrate by animal experimentation, really did occur after such resection.

In order to accomplish this the following procedures were undertaken: The stomach was divided transversely at the middle and either directly anastomosed again or the cut ends turned in and sutured over and a gastro-enterostomy done on the proximal segment. A fistula was established leading into the antrum and another made just beyond the pylorus, or in another series the duodenum was cut across and the distal stump inverted, while the proximal was brought up into the abdominal wound.

If one, then, filled the pyloric antrum with water and maintained a constant pressure through the fistula, it was invariably noted that regular spurts of liquid flowed out from the duodenal fistula every 12 to 14 seconds, deducing therefrom that at these intervals the pyloric sphincter was regularly relaxed and closed, the former being judged by the appearance of the spurt from the duodenal fistula, indicating further that the pyloric antrum was performing a very definite work. Also that if a registering balloon was placed into the antrum and connected with a revolving drum, a very regular curve demonstrated the movements of the antral musculature. The pressure exerted in the antrum may rise to 45 mm.Hg.

This absolute evidence that with each contraction of the antrum there must necessarily be at the same time a relaxation of the pyloric sphincter, as evidenced by the simultaneous ejection of fluid through the duodenal fistula, is a very strong indication that the effectiveness of the movements of the stomach as far as regards the co-ordination of these two parts of the organ is in no manner disturbed.

In the normal stomach the flux into the duodenum ceases at that moment when the duodenal reaction becomes acid. This chemical reflex from the duodenum has also been demonstrated on animals by means of introducing dilute hydrochloric acid into the duodenal fistula, at which time the movements of the antrum stopped immediately and were only renewed when the reaction in the duodenum became alkaline. These observations establish the fact that the emptying of the stomach does not cease as a result of a reflex contraction of the pyloric sphincter, as has been heretofore supposed. From the preceding animal experimentations the authors conclude that in dogs the pyloric sphincter and the pyloric antrum retain their efficiency after a transverse resection of the stomach—in a condition, therefore, where the vagus is separated from the sympathetic system and where the functional correlation of the cardial segment is interrupted.

Theoretically, this important observation agrees with the clinical experiences in cases where a transverse resection of the stomach has been done, as it is with great exception that any disturbance of the gastric motility is noticed immediately after such operations.

Dr. Haudek (Wien) in the discussion drew attention to the following differential points between ulcer and carcinoma:

1. Morphologically: (*a*) Ulcer appears under the X-ray by direct examination as a raised shadow, while medullary carcinoma appears retracted. (*b*) In high-lying ulcer on the lesser curvature of the stomach, it assumes a snail shape, owing to the wrinkling and diminution of its lumen, as the lesser curvature is rolled in while the attachments remain fixed. In the diffuse infiltrating carcinoma, the pylorus in the lowest point and the fundus is raised up, and the stomach appears stretched out and no longer hook shaped. (*c*) In hour-glass stomach with an ulcer basis, the canal joining the two sacs remains on the lesser curvature, and the aperture consists only of a small well-circumscribed spot. In hour-glass stomach with a carcinoma basis (very infrequent), the opening is frequently median and there is present a much longer canal.

2. Functional: In cases of ulcer of the stomach, it retains its contents much longer than normal, due to pylorospasm. In carcinoma not involving the pylorus, the stomach empties very quickly (pyloric insufficiency).

It is difficult to differentiate a primary carcinoma from one with an ulcer basis, and this is also true on interpreting the pictures of pyloric stenosis, whether it is due to a benign or malignant process.

III. DUODENAL ULCER.

Dr. Arthur Neudörfer (Hohenems) reported that in a series of 100 operations performed by him on the stomach, 73 cases of ulcer were found, among which were 8 instances of duodenal ulcer. This number is exactly the same as in a series of 63 cases reported by Schmitt, in which there also occurred 8 instances of duodenal ulcer. From these observations, Neudörfer deduced that patients suffering from duodenal ulcer were much more frequent in the neighborhood of Hohenems than was ordinarily appreciated, and stated further that the diagnosis might be made at the bedside in the majority of cases. Thus he had been able to diagnose this condition in all of the last five cases operated. In his experience, the symptomatology of duodenal ulcer was a very precise one, and not easily confounded with any other disease.

There are two types: First, those in which pain was the most important symptom. In these cases it never occurs before three hours and never later than six hours after the main meal. It is noticed usually twice daily, generally about 6 P.M. and around midnight. There exists a marked periodicity of the spells of this distress, so that even months of freedom from pain ensue either in cases treated or in those untreated.

The second class includes those cases in whom there occur periodic hemorrhages, which may merely evidence themselves in fainting spells. Hæmatemesis is seldom present. There is usually no disturbance of the stomach, either in its size or function. As a rule there is a condition of hyperchlorhydria present and a point of tenderness under the centre of the right rectus muscle and above the umbilicus and a slight rigidity of this muscle.

Of particular interest in differential diagnosis is the consideration of cholecystitis, and in this connection the character of the pain must be given the position of greatest prominence. There is no curative therapy. The only relief appears to be offered by a gastro-enterostomy with a diminution of the size of the pylorus.

The speaker in conclusion emphasized the fact that duodenal ulcer should always be thought of in patients who complained of epigastric distress which recurred regularly, and stated that he believed that if a more careful examination was made, the relative frequency of this condition would be much greater.

DR. HAUDEK (Wien) in discussing Neudörfer's paper stated that in those cases in whom the diagnosis of duodenal ulcer was not absolutely evident, great aid could be obtained by an X-ray examination. He had examined eleven such cases in the course of five months and found evidences of the ulcer present. Six of these had been operated and the diagnosis confirmed. The following features were remarked: One may notice occasionally in contradistinction to pyloric ulcer that the bismuth water passes directly over into the duodenum immediately after its ingestion—that evacuation may thus spontaneously follow. That he has been able in positive cases, by thus demonstrating the position of the viscus in question, to localize the ulcer by a point of tenderness especially on deep pressure by drawing or pushing the stomach forward. That there is usually an appreciable resistance felt which frequently occurs in instances of callous ulcer. That the time of evacuation of the stomach is only very slightly increased, so that six hours after a Reider meal, the stomach is empty or there remains only a small amount of bismuth. If the ulcer be of the penetrating variety, a picture is presented similar to that described by Nischen in infiltrating ulcers of the stomach, a persistent fleck of bismuth which is distinguishable from the rest of the duodenal contents, which does not seem to alter its position easily, and corresponds exactly with the point of tenderness elicited on pressure.

In further differentiation of this condition from pyloric ulcer in those cases presenting points of tenderness to the right of the umbilicus and distress several hours after eating, it is important and of value to consider that the localized tenderness is behind the pylorus, the difference in the time of evacuation of the stomach being relatively shorter.

It is difficult further to differentially diagnose ulcer of the duodenum from some of the forms of adhesions about the pylorus which have resulted from inflammatory processes in the gall-bladder, in which cases there may also be present a localized point of tenderness and a period of distress a few hours after eating, and in whom the time of emptying of the stomach is not at all or in no very great degree increased.

FREIHERR V. EISELSBERG (Wien) considered the diagnosis of ulcer of the duodenum is made in many instances from the regular recurrence of pain several hours after eating and from blood in the stools. It does not occur in the vicinity about Wien with such frequency as in England and America. Perhaps this may be accounted for because just the position of the pylorus and which ulcers lay on one side and which lay on the other may not have been appreciated. The position of the pylorus is marked by a circular vein (Mayo), which should be identified and used as the only absolute landmark.

Operatively considered, a gastro-enterostomy accompanied by a one-sided narrowing of the pylorus seems to give the best results. This procedure was published by the speaker in 1895. Although he first used this method, Doyen, in 1893, had also had opportunity to employ it in two cases. Resection is without doubt the ideal method of dealing with the ulcer, as all know that it may undergo a carcinomatous degeneration. This is especially true of those situated in the very beginning of the duodenum. A simple gastrojejunostomy is undertaken alone in those cases in which the patient is in a precarious condition from hemorrhage, or in whom the ulcer may have already perforated, where a longer operation would endanger the patient's life.

The author bases his remarks on an experience of 30 cases. One was resected, nine were treated by an occlusion of the pylorus, and the remainder by a gastro-enterostomy only. With the exception of one case of pyloric exclusion, which later developed a peptic ulceration, none of the patients died following the operation.

Eiselsberg believes operation to be the only correct treatment for ulcer of the duodenum, and agrees fully with the views of Jonnesco, that if no contraindications exist, it should consist of a unilateral exclusion of the pylorus.

IV. MOBILE CÆCUM AND CHRONIC APPENDICITIS.

Prof. Dr. Wilms (Heidelberg) said that the attacks of pain grouped under the terms of chronic appendicitis can be traced to the following disturbances: (1) adhesions in the neighborhood of the appendix or ascending colon, causing traction on the intestine when it is full; or (2) kinks or twists of the intestine at the caput coli or hepatic flexure, causing transient obstruction. Cæcum mobile, or the conditions termed by other writers as typhlospasm, typhloatony, or typhloectasia, has nothing whatever to do with these disturbances, these as a rule being due to the stagnation of intestinal contents over a long period of time in the cæcum. The contents may remain in the cæcum for 24 hours or more, as demonstrated conclusively by Röntgen pictures. Their consistency becomes thick, and the rest of the colon is forced to exert greater power to push these thickened contents on. The patients suffer with habitual chronic constipation. As a result of this stasis, an antiperistaltic action takes place in the colon, together with a spastic condition due to the irritation, thus causing the attacks of pain. These spastic contractions, which go together with a lengthening of the cæcum, result in traction on the movable cæcum and its mesentery, or when the appendix and its mesentery are relatively short, traction is brought on the mesenteriolum. The pain of chronic appendicitis is thus traction pain, aggravated by slight inflammatory changes in the environment of the mesenteric nerves.

Excepting palpation (gurgling tumor), the diagnosis is positively established by means of an X-ray picture. Wilms recommends three pictures, 4, 8–10, and 24 hours after the administration of bismuth. His results with cæcopexy show that not only is the pain relieved, but that the chronic obstipation also is cured. Not less than 75 per cent. of the operated cases had after this treatment normal bowel movements, whereas formerly their bowels would move only after cathartics. In uncommonly large cæci, Wilms recommends, instead of cæcopexy, a shunting of the colon by anastomosing the small intestine lying over the cæcum to the transverse colon. Only those cases should be operated on in which the obstipation has not yielded to thorough internal treatment, *i.e.*, in severe cases accompanied by pain.

Dr. Sonnenburg (Berlin) observed that notwithstanding the laudable efforts of Dr. Wilms, the surgical treatment of obstipation and its complication is still upon an uncertain foundation. Mobile cæcum is not frequent, by itself not pathological, and the methods of anchoring it vary considerably. The diagnosis by the X-ray picture is not trustworthy, as the form, location, and distribution of the bismuth cæcal shadow depend entirely upon how soon after the ingestion of the mixture it is observed. The accumulation in the beginning of the large intestine in itself is not pathological. The findings mentioned by Wilms can be observed in other forms of obstipation as well as in healthy individuals. The quality and the quantity of the ingested substance must be borne in mind in order not to confound physiological with pathological phenomena. Cæcum mobile can be recognized only when clinical evidences are present, pointing to catarrh and inflammation, from the seat of a typhocolitis. Then there are present symptoms of catarrh of the large intestine, with varying obstipation and diarrhœa, accompanied by typhloatony. Altogether a patient is better off with a cæcum mobile than one with a fixed cæcum. It is difficult to see what advantage is gained by cæcopexy. Unquestionably, many patients who have typhlocolitis are operated upon for appendicitis, which is not present. On the other hand, many of these patients who are operated upon for chronic appendicitis, by their appendectomy are cured of their typhlocolitis. Typhlocolitis belongs to the domain of internal therapeutics, and only in extraordinary cases is operation called for. It is usually only part of the inflammation of the large gut and the cause is often elsewhere, for example, at the splenic flexure where obstruction is present, with damming back of the colonic contents. We are not justified in making a clinical entity of mobile cæcum and its symptoms, and unless we are more familiar with the physiology of the large intestine than at present, we should avoid shunting, resections, etc. The speaker has not seen much benefit derived from these operations.

Dr. Klose (Frankfort am Main) said that since 1904 the Frankfort Surgical Clinic has recognized the existence of cæcum mobile as described by Wilms. During this time 154 cases have been operated on, with a complete cure in 89 per cent. Klose does not agree with the stand-point of Wilms that the mechanical interference with the progression of intestinal contents due to torsion of the hepatic flexure plays the greatest rôle in these cases. One gets secondarily hypertrophy and atrophy of the walls, inflammatory changes in the region of the cæcum and ascending colon, as well as chronic torsion and displacement of these organs. The habitual torsion is, according to observations, the most important and frequent cause of acute appendicitis. Cæcal torsion may also give rise to floating kidney and infective pyelitis.

Klose reports experiments on the cadaver to support this mechanical theory. The cæcum and entire ascending colon are fixed to the lateral abdominal wall, in order to prevent rotation. More recently, he has gone so far that, in marked cases of displacements and severe enteroptoses, he has fixed in place the entire large intestine, liver, and spleen with good results. As a result, the neglected field of enteroptosis has been offered relief through surgical treatment.

Dr. Goebell (Kiel) since 1908 has performed 15 cæcopexies and 3 cæcoplications for cæcum mobile. Only those were grouped under this head in which there was a freely movable cæcum, and where there existed at the junction of the cæcum and ascending colon adhesions with occasional kinks.

The cæcopexy was done by sewing the lateral band to the transverse fascia by means of silk thread. Only when the caput coli was very distant from the iliocæcal junction, after doing an appendectomy, a plication of the cæcum was performed. Of 15 operated patients, 10 were entirely cured. Good results were obtained only when the cæcum mobile was the primary cause of the obstipation.

Dr. Dreyer (Breslau) stated that in order to clear up the doubtful subject of cæcum mobile, two questions must be answered:

(1) Is a mobile cæcum pathological? (2) Does the Wilms cæcopexy restore the physiologic condition?

In answer to the first question, he notes that out of a large number of autopsies he has found in 67 per cent. a movable cæcum. It seems scarcely possible that this condition can be pathological and, as Wilms states, the primary cause of obstruction. In answer to the second question, all know that the pregnant uterus in its rise displaces the entire intestines upward. In the latter months of pregnancy, the cæcum is found far above a line joining the anterior superior spines of the ilium.

With the Wilms cæcopexy, the head of the cæcum is fixed deep in the pelvis so as to reach the outlet, in order that, as Wilms describes it, the retroperitoneal pocket shall take up all of the "long" movable cæcum, so that no kinking can take place. The danger here is, that during pregnancy a loop is formed, with the iliocæcal valve as the angle and the intestine as the parallel arms. This would make great difficulty for the passage of fæcal matter. It is interesting to note that of the 52 cases Wilms has operated on for cæcum mobile 75 per cent. were in women. In the autopsy room only 11 per cent. of women were found to be free from cæcum mobile, but never was the cæcum fully movable to the site of a possible cæcopexy. The clinical relation of cæcum mobile to chronic appendicitis is not yet sufficiently clear.

Dr. Fromme (Berlin) said that anatomical observations and investigations regarding the anatomy of the cæcum during pregnancy had taught him that this organ, as Dr. Dreyer has explained and as is pictured in Corning's Atlas, is during the latter half of pregnancy displaced upward to a marked degree. The pain in the right side, of which many women complain during the latter half of pregnancy, and which is thought to be due to chronic appendicitis, is in his opinion nothing else but the contraction pain caused by traction on a cæcum that is firmly fixed. There must exist a movable cæcum in women to some extent. On the other hand, a too movable cæcum is exposed to the danger of rotation on its own axis as soon as the uterine pains set in. Such cases of volvulus at the termination of pregnancy are reported more frequently now, he, himself, having seen one such case in 1903.

Dr. Voelker (Heidelberg) said that the introduction of the subject of cæcum mobile by Wilms is welcome to all surgeons who have been dissatisfied with the treatment of and indications for chronic appendicitis; and it is interesting because, besides the schematic and unsatisfactory removal of the appendix, other therapeutic measures are available. The point that is not clear is whether the pain is due to abnormal mobility of the cæcum (Wilms) or to a dilatation (typhloatony, Fischler). The treatment differs according to the view accepted.

In fixation of the cæcum, one must bear in mind that the cæcum is a hollow viscus. It makes no difference whether the fixation is retroperitoneal (Wilms) or to the parietal peritoneum (Rehn, Klose).

The hollow organs are physiologically provided for changes in size and are naturally movable. One cannot use the same methods as with the solid viscera (kidney, liver, spleen, and uterus).

Most important is the following point: If one finds in cases of chronic appendicitis adhesions resulting from previous inflammatory attacks, joining the intestine and the abdominal wall, the pain is ascribed to this cause. It seems that now, however, an abnormally movable cæcum is just as important a cause for the pain. It is surely a fine point to decide in each case to which group it belongs.

Without much thought and consideration, one naturally comes to the conclusion that where adhesions exist to remove them, and where they are not present to artificially create them.

If the dilatation is considered the important factor, it seems only fair to remedy this, rather than to fasten the intestine. Voelker recommends that in those cases where the cæcum gives clinical evidences of dilatation to plait it lengthwise (Bircher, *Med. Clinic,* 1910).

After removing the appendix, Voelker sews together the middle and outer bands with a continuous suture for about 8 cm. By this means the anterior portion of the cæcum is invaginated. If the greater part of the cæcum is below, and if the bands are short, the cæcum can be shortened by the suture. At the same time the space under the mouth of the ileum is lessened and there can result no accumulation of contents. Likewise a partial fixation is obtained, as the anterior portion of the movable cæcum is contracted. On the plaited portion is reflected the posterior surface. This plaiting is indicated only in large dilatations. In 12 cases satisfactory results have been obtained. Especially in one case after the plaiting a previous long existing temperature disappeared. The case is a good example, as the appendix had been removed previously, and the plaiting only was done. Stenosis of the cæcum or ileum can be avoided with care.

Dr. Stierlin (Basel) reported the after results of three cases of shunting of the cæcum and ascending colon for severe obstipation of the ascending type. Two of these cases were operated by Prof. Wilms and the third by Prof. de Quervain. In the three cases, before the operation, the bismuth shadow persisted for 24–48 hours in the cæcum and ascending colon and lower down in the intestine in the form of fecal masses. After operation no shadow is visible after 24 hours. Disregarding the X-ray pictures, the clinical results are satisfactory. In all the cases the obstipation has disappeared, the patients having daily movements. In the case operated upon by de Quervain, the plication of the shunted colon was done, making it very narrow at the hepatic flexure to allow for drainage of its secretion, yet permitting no return flow of the fæces.

The indication for shunting as well as the improvement after operation was shown by the X-ray pictures.

V. ON INTESTINAL COMMUNICATIONS WITH THE BILIARY PASSAGES AND THE PANCREAS.

Dr. Kausch (Berlin) reported as follows: 1. *Cholecystenterostomy:* With the results of this operation he is not satisfied, although an entero-anastomosis was always performed in addition. He lost several patients through cholangitis. Kausch therefore advises, if it is possible, to perform cholecystogastrostomy or duodenostomy, the former being recommended especially by Hildebrand.

But not in every case will it be possible to avoid cholecystenterostomy. Under such conditions Kausch proceeds in the following way: in the first place, an entero-anastomosis is performed; the side-piece of the intestine which leads away from that point is cut through close to it and both ends closed. The longer one is connected with the gall-bladder, and this part of the intestine changed into a narrow canal by continuous suture of the serosa.

2. *Hepatocholangi-enterostomy:* This operation has the simpler name hepato-enterostomy. Kausch always performs it now in two intervals, hepatostomy first. His reasons are: (*a*) if the operation is not divided into two parts, the strain is too great; (*b*) it is harder to stop hemorrhage; (*c*) one never knows whether, after the relief of the liver, the physiological passage will not become free and the major operation be rendered unnecessary. It is best to enter the liver from the gall-bladder, and afterwards to connect the latter with the intestine.

3. *Formation of a new biliary duct:* This operation may sometimes become necessary, and the several procedures of this kind have already been described. Kausch gives the advice to form the new biliary duct out of the intestinal wall by plastic operation, as it is described in the *Zentralblatt für Chirurgie,* 1911, p. 159. The patient thus treated was entirely cured; the operation was done half a year ago.

4. *Intestinal communication with the pancreas:* It is easy to extirpate the tail of the pancreas, yet more difficult to do so with the central portion. The removal of the head of the pancreas involves the greatest difficulty, particularly because of the connection of the rest of the pancreas with the intestine. Simple implantation of the duct is unsafe, because the broad surface of the incised pancreas is secreting. In one case of papillary carcinoma Rausch removed the head of the pancreas and turned the transversely bisected duodenum over the incised surface of the pancreas. The case is described in the *Zentralblatt,* 1909, p. 1350. Nine months after operation patient died from cholangitis. The postmortem showed that intestinal communication with the pancreas was working excellently; nowhere any metastasis.

URINARY ORGANS.

I. ON THE PATHOGENESIS OF RENAL TUBERCULOSIS.

Dr. Pels-Leusden (Berlin) referred to his experiments to produce renal tuberculosis, briefly outlined at the Congress of 1905. The arrangement of the experiments, briefly repeated, was the following: small doses of oily infusions of pure cultures of tubercle bacilli of the type bovinus and of differing virulence were injected directly into the right renal artery of large animals, goats and dogs. The animals died at different intervals or were killed from five weeks to nearly six months after infection. A number of photographs were shown which prove that it is possible by this mode of infection to obtain unilateral renal tuberculosis with certainty in all cases. In using bacilli of very weak virulence, the experimenter succeeded in limiting the tuberculosis to the right kidney which thus represented the only diseased organ. In all cases the presence of the bacilli could be demonstrated in the diseased organs. The pictures shown also prove that the changes thus produced in the kidney may in a large measure correspond to those of the so-called surgical renal tuberculosis. Some pictures specially show very characteristically tuberculosis of the medullary cones. Because of these results, the author considers himself justified to draw the conclusion that the mode of infection chosen by him corresponds closely to that found in human bodies. A detailed discussion will shortly appear in Langenbeck's archives.

A great part of the animals experimented upon died of pulmonary tuberculosis, but only when injected with fully virulent bacilli. The exact examination of the other organs revealed the fact that they were essentially healthy, the left kidney especially was only very exceptionally the seat of some small tubercles.

With regard to the spread of tuberculosis upon the excretory (deferent) urinary passages, the author has not yet arrived at a definite conclusion. He did obtain in some cases very fine tuberculosis of the renal pelvis. He also observed the spreading of material containing tubercle bacilli into ureter and bladder. But in both of the latter organs were found only symptoms of inflammatory irritation, which, to be sure, prepare the ground for subsequent infection. Only in one case at the vesical orifice of the right ureter, therefore on the infected side, there was an entirely fresh tubercle with numerous bacilli, while the other portions of this ureter, the left ureter, and the other part of the bladder were positively free from tuberculosis. This is possibly to be understood as an incipient descending infection.

The preliminary conditions for the success of the experiment in the opinion of the author are the following: (1) one must choose large animals, goats, sheep, dogs; (2) one must introduce the material containing the bacilli immediately into the renal artery; (3) the bacilli used must have but a mild virulence, hence bacilli of the type humanus are perhaps more to be recommended, as they are usually not so virulent for animals as those of the type bovinus; (4) these bacilli must be injected in very small quantities only; (5) one must, by infusing the bacilli in oil or by adding other substances, such as lycopodium, which cause a slight embolus, force them (the bacilli) to remain longer at one point of the system of renal vessels.

The conclusions which the author draws from these experiments and from investigations already previously published, together with (Privy-Councillor) Koenig, are the following:

1. The chronic, unilateral renal tuberculosis is in the vast majority of the cases a hæmatogenous one (Baumgarten).

2. It is caused by small emboli containing bacilli (small particles of tissue, fat drops, etc.) which eventually have passed the pulmonary capillaries. This is a regular occurrence in the case of fatty emboli, for instance.

3. Individual bacilli circulating in the blood pass the renal circulation without bad effect.

4. The differences between his results and those of Friedrich, who on introducing bacilli of weak virulence into the blood circulation could not produce any essential renal tuberculosis, but on the contrary on using bacilli of full virulence found the kidneys to be the most diseased organs, are explained in part by the different arrangement of the experiments (cf. the article in Langenbeck's Archives).

5. In the case of severe cheesy (caseous) renal tuberculosis with obstruction of the collective canaliculi, the tubercular process may spread backward by means of the uriniferous tubules. To the best of the author's knowledge, this explanation was first given by himself and was later on accepted by Kuester and J. Israel.

6. The theory, advanced by Tendoloo and accepted by Brongersma, that tuberculosis of the renal marrow arises in lymphatic ducts, is to be considered as yet unproved.

7. The mode of infection hitherto mentioned is also to be recommended for the experimental investigation of tuberculosis of other organs, especially if one wants to undertake therapeutic experiments.

BLOOD-VESSELS.

I. SAPHENOFEMORAL ANASTOMOSIS, TRANSPLANTATION OF THE VENA SAPHENA INTO THE VENA FEMORALIS BY MEANS OF VASCULAR SUTURE, AS AN OPERATIVE METHOD OF TREATMENT.

Dr. Wilhelm Schaack spoke on the theoretical part with anatomical investigations; Dr. Erick Hesse on the clinical part.

The operative methods of treating varices used until now do not give ideal results nor do they protect against relapses. It is comprehensible, therefore, that new methods are being sought for.

In 1906 Delbet advised a new operative procedure for a certain group of varices which by means of *transplantation of the vena saphena into the vena femoralis at a new place by vascular suture produces normal physiological conditions for the venous blood circulation.*

For a certain large group of varices the static and mechanical factors are of prime importance etiologically. Furthermore, the condition of the valves in the diseased veins and their insufficiency are of great importance. The abnormal reflux of venous blood which can be observed in Trendelenburg's experiment can be explained only by insufficiency or absence of valves. To prevent abnormal reflux, ligature was proposed by Trendelenburg. This operation, however, can give good results only when sufficient anastomosis exists between superficial and deeply situated veins. Anatomy teaches that such anastomoses do not exist in sufficient number nor in the required grouping. These unfavorable conditions may be changed, if the recurrent blood wave is stopped and the engorged blood is allowed to flow off. Delbet says he accomplishes this by transplanting of the vena saphena into another vein with valves capable of functioning normally.

In the vena femoralis below the original junction with the saphena there is always a great number of valves. If the vena saphena is transplanted below such a pair of valves, the abnormal pressure from above can be checked by means of the interpolated valve. Furthermore there is the possibility of a normal deflux (discharge) through the newly constructed anastomosis. The operation is performed briefly as follows: longitudinal section in Scarpa's triangle, exposition, isolation and mobilization of the vena saphena and femoralis. The vena femoralis is grasped 12 cm. *below* the mouth of the saphena with two vascular clamps, and the bisected vena saphena is implanted by means of a vascular suture into a longitudinal section, about 0.5 cm. long made in the vena femoralis—an end-to-side anastomosis between the vena femoralis and the vena saphena. Hesse and Schaack executed the saphenofemoral anastomosis in 23 cases in the surgical division of Prof. Zeidler in the Obuchow Hospital in St. Petersburg.

To justify performing this new operation, one must be sure that the valves mentioned are present in the vena femoralis. As no definite statements are to be found in anatomical literature about the distribution and situation of the valves of the veins in question, these investigations were executed by the authors in the pathologic institute of the Obuchow Hospital. One hundred corpses were examined, of which an equal number of anatomical preparations of the vena femoralis together with the vena saphena was taken. The relations of the valves and their distances upward and downward from the issue of the saphena into the vena femoralis were noted. Of the facts thus established the most important with regard to saphenofemoral anastomosis is that in the vena femoralis there are *always pairs of valves below* the mouth of the saphena, at least one pair in each case, but in most cases (73 per cent.) two to three and even more. In rare cases the first pair of valves in the vena femoralis is found but 7 to 10 cm. below the inosculation of the saphena, in the majority of cases only 3 to 4 cm. below. It follows, therefore, that the new anastomosis must be made 10 to 12 cm. below the inosculation of the saphena.

The vena saphena implanted 10 to 12 cm. below its original junction is now *under protection of a pair of valves.* The recurrent blood wave is stopped by the pair of valves. Furthermore, the veins can empty normally upward through the anastomosis. Experience proves that the dilated veins, when liberated from abnormal pressure, can resume their normal size. The height of the blood-pressure in the dilated venous sphere of the saphena becomes comprehensible, if one realizes that a blood column, commencing from the vena cava, the vena iliaca, and the vena femoralis, presses upon the wall of the saphena; this blood column, in consequence of the insufficiency of the valves, is checked at no place in its course.

This valvular insufficiency, which is of great importance etiologically in a certain group of varices, can be removed by saphenofemoral anastomosis. Hence this operation must also provide a radical cure for those cases of varices which are due to this valvular insufficiency.

Clinical Observations.—Since Delbet published, in 1906, the first communication on the practical application of his method in eight cases, nothing had been reported by other authors about this operative procedure. It was the authors' intention to examine Delbet's theoretical considerations, which were undoubtedly correct, although yet not tested with regard to their surgical value at the hand of material at their disposal.

They performed saphenofemoral anastomosis by means of the vascular suture in 23 cases at the Obuchow Hospital for men in St. Petersburg.

Of these cases 9 were operated by Schaack, 11 by Hesse and 3 by other surgeons.

As Prof. Delbet informs the authors by letter, 25 cases in his clinic have so far been operated upon successfully in accordance with the above principles. Thus,—as far as they are aware,—a total of 48 saphenofemoral anastomoses have been performed to date.

It should be said that in the majority of cases the patients operated upon were affected with a strongly pronounced complex of varicose symptoms. In several cases racemose masses and bundles of dilated veins were present.

Of their 23 patients, 16 at the same time had ulcers of the leg.

The chief incision is made in Scarpa's triangle in the direction of the large vessels. The vena saphena, after being exposed in the region of the incision, is mobilized sufficiently to allow anastomosis to be applied without any tension.

If lateral branches of the saphena are found they must be ligated. The same holds good for accessory saphenas. Thereupon, the saphena to be anastomosed is ligated as high as possible. From experience the authors know that this place of ligation is situated about 4 to 5 cm. below its inosculation with the vena femoralis. After applying a Hoepfner's vascular clamp to the peripheral end of the saphena, the latter, in order to allow of an easier performance of anastomosis, is cut through obliquely. Then the femoral vein is isolated for a distance of 5 to 7 cm. from the femoral artery. After that both its ends are closed temporarily by Hoepfner's clamps. Then the vena femoralis is opened according to the lumen of the saphena and the continuous vascular suture follows a real side-to-end anastomosis. Thereupon the clamps are slowly loosened. In most cases a small hemorrhage now occurs in the stitch canals which stops after some compression. In five cases they witnessed a stronger bleeding, so that they had to proceed to supplementary sutures.

Then the region of the anastomosis is covered by one or two interrupted silk sutures, which grasp the sartorius and adductor muscles. Now follow skin suture, dry dressing, and immobilization in a wire splint which remains two or three weeks.

According to their experience and investigations on cadavers it is sufficient to apply anastomosis about 12 to 14 cm. below the physiological inosculation of the saphena, which would correspond to a distance of 20 to 25 cm. from Poupart's ligament. In applying anastomosis at this height, one may be sure of having implanted the saphena below one or two working valves.

In 22 cases a wholly undisturbed healing process took place.

In one case a severe wound infection occurred to which patient succumbed on the twenty-sixth day after the operation. The first seven days in this case passed without any reaction; then only the temperature began to rise, and on the ninth day streptococci in the general circulation could be demonstrated. Later a general infection set in with metastases, originating from a purulent thrombophlebitis of the saphena and femoralis. The cause of the infection cannot be stated with certainty; the possibility of infection from non-sterile silk used for the vascular suture is at all events to be considered.

This case, although regrettable in itself, cannot be laid against the method as such. On the other hand the great danger from this interference with the blood-vessels is evident because of the possibility of the infection being directly transmitted to the general circulation.

All of the other cases could be dismissed with wounds which had healed primarily.

In regard to results, they were thoroughly satisfying.

To be sure, one cannot expect absolute disappearance of the varices in the beginning. For the authors did not cut away the diseased veins; they were forced to act normally. In consequence it cannot be expected, of course, that large, dilated veins disappear in a trice. Only after longer observation shall we be able to notice a diminution and disappearance of the varicose dilations.

The most important and above all the most conspicuous phenomenon which must appear after the saphenofemoral anastomosis is the disappearance of Trendelenburg's symptom, previously present. If negative reaction occurs, it only proves that between the saphena and the whole ascending venous territory one or more working valves have been inserted. Consequently the anastomosis has fulfilled its purpose.

In all the cases it was possible to demonstrate the disappearance of Trendelenburg's symptom, which was positively present before.

A second condition which we must require of a successful anastomosis is that it allows free passage. The cases operated upon demonstrated this point also sufficiently.

As to the effective results, the authors could ascertain in all their cases a diminution, even repeatedly a complete disappearance, of the varices. In every case the ulcers which had hitherto defied every treatment healed. Even in an especially obstinate case of circular callous ulcer, full cicatrization could be observed in 25 days in connection with the anastomosis.

Œdema was never observed. Subjective troubles, such as cramps, pains, and fatigue in the legs, also disappeared.

As to lasting results, Delbet's observations on 25 cases are very satisfactory. Their observations are at first of too short duration to allow conclusive judgment. Hesse wished to mention briefly that they were able to follow several cases for one year with excellent results.

The procedure is indicated: (1) for strong and otherwise healthy persons; (2) only in the case of valvular insufficiency of the saphena, when the indicator of the insufficiency, Trendelenburg's symptom must give a positive reaction; (3) the varices must be situated within the range of the vena saphena magna; (4) their trunk must allow of free passage.

This method is contraindicated: (1) for sick and weak persons; (2) if the varices did not originate through valvular insufficiency, *i.e.*, if Trendelenburg's symptom is negative; (3) in the case of inflammation and thrombosis of the vessels to be anastomosed; (4) if the varices are not situated in the region of the saphena magna; (5) in cases in which an infection of the lymph passages of the thigh can be assumed, for instance after recovery from several attacks of erysipelas, in the case of dirty, inflamed ulcers, etc.; (6) in too strongly sclerotic changes of the saphena and femoralis; (7) in case of too small a calibre of one of the two vessels. Large, even circular ulcers should not be considered as a contraindication, as their material demonstrates.

What objections may be raised against saphenofemoral anastomosis?

1. *The dangers which result from the vascular suture.*

In the first place the greatest danger in this connection is that of primary infection and of the quick entrance of the infecting germs into the general circulation.

The objection to the method which the danger involves, is certainly possible. In fact, a case was lost in this way. But this one case does not offer conclusive proof. All the other 47 cases which took a favorable course are a splendid counter proof of the innocuousness of this method.

In the second place *emboli* are theoretically to be considered. The possibility of such a complication is theoretically to be conceded, and the material of 47 cases hitherto operated upon which developed favorably may still be too small to allow of concluding that emboli do not occur. But on the other hand, pulmonary emboli take place in connection with ligations and resections of the saphena, so that the danger of a pulmonary embolus, therefore, is not at all especially restricted to saphenofemoral anastomosis.

2. *The disproportion of the slight ailment with the extremely difficult interference.*

This is without question the most serious objection. On the other hand, the suffering of patients afflicted with varices lasting for years is not at all thought of too slightly. Furthermore, all other methods of operating show relapses in a certain number of cases, and therefore the search for a new physiological procedure is quite comprehensible.

It is in the saphenofemoral anastomosis that we possess the first step to an operation which is intended to create physiological conditions, and therefore a trial of this method is justified.

Should the future confirm the permanency which present results promise, then saphenofemoral anastomosis has justified itself.

DISLOCATIONS.

I. THE REPOSITION OF INVETERATE TRAUMATIC LUXATION OF THE HIP-JOINT.

Dr. Julius Dollinger (Budapest) reported results obtained in the treatment of 22 inveterate traumatic luxations of the hip-joint. Of these he set by the bloodless method four lux. iliacæ of 4, 6, 8, 9 weeks' standing and one lux. sciatica of 7 weeks' standing. Besides this he tried bloodless setting in other cases, but without success. The subsequent arthrotomy showed contusions and abrasions of the head of the femur. Therefore Dollinger later on employed the bloodless reposition only in those cases which showed a certain motility. In 17 cases he performed arthrotomy. Here he gave his chief attention to those pathologico-anatomical changes which prevent reposition. These should be read in the original paper, which will soon be published in the *Ergebnisse der Chirurgie,* vol. iii, Payr-Kuettner.

The essential changes are:

1. *Changes at the acetabulum.* It was in every case, except one, filled with connective tissue that consisted of shreds of the capsule and of fat, and had grown firmly together into one lump. This mass clung so closely to the acetabulum that it could be removed only with great difficulty and had to be cut out piece by piece. Underneath it the cartilaginous cover of the acetabulum was intact and eroded only in cases of very long standing.

In seven cases there was fracture of the acetabulum, in two cases of the pelvis.

Reposition is only possible when the acetabulum is empty. The bloodless operation could have been performed only in one case out of the 17.

2. *Changes in the head of the femur.* In a case 9 months old the caput femoris presented a gnawed-like appearance at the perichondrium. In some cases, in which attempts at reposition had preceded, it was crushed or excoriated, otherwise mostly intact or little damaged. In its new position it was surrounded by periosteal neoplasma which formed a wall around it. The collum femoris was in most cases attached to the pelvis by cicatricial tissue.

3. *The articular capsule* could not be dissected free from the cicatricial mass, nor could one ascertain whether the capsular rupture was really constricted.

4. *The muscles* whose insertions had approached each other were shortened. This contraction, however, was overcome by manipulation or by means of a block-and-pulley. Exposition of the bone was not necessary in any case. Only in one case the pyriformis and obturator internus, with the gemelli muscles, were cut through. Otherwise the muscles were kept intact. The quadratus femoris muscle was intact only in one case, otherwise always torn apart. The important rôle played by the pyriformis, obturator and gemelli muscles with regard to different luxations has hitherto not been studied in sufficient detail by surgeons. It is of great consequence and will be specifically referred to later under several forms of luxation.

Arthrotomy.—After different sectional methods Dollinger decided on an incision which runs from the spina posterior inferior to the base of the trochanter major.

Luxatio Iliaca.—The head lies under the gluteus magnus muscle. Its communications as well as those of the collum femoris with the pelvis are cut through. The neck and the shaft of the femur bar the way to the acetabulum. By means of flexion and strong inward rotation of the thigh this way is cleaned. Now the acetabulum is still covered by the pyriformis, obturator internus and gemelli muscles, which, because of their great tension, were regarded by the author as cicatricial masses. These were pulled upward. Then, illuminated by the electric frontal reflector, the acetabulum is cleaned and then, by means of circumduction, reset by manipulation, if possible. But everything necessary for using the block-and-pulley must be applied to the patient beforehand. He remains in a lateral position, and the pull is exerted when the thigh is flexed 90°, as in the case of reposition by means of elevation. Dollinger performed 8 arthrotomies on account of luxatio iliaca; of these he set 7; in one case in which an attempt at bloodless reposition had been made before, the head was crushed and partially denuded from cartilage. In this case resection was performed.

Luxatio Sciatica.—The head lies under the acetabulum, the access to which is closed by the aforementioned four muscles. These must be loosened from the acetabular margin and pulled upward. Now the acetabulum is emptied, then or even before the connections of the head and the neck loosened, the thigh bent and greatly abducted, whereupon the head leaves the wound and enters the acetabulum. If this is not the case, the luxatio sciatica becomes a luxatio iliaca, to set which circumduction should be used. All manipulations for reposition should be performed by a special assistant under the direction of the operator. The latter should not perform them, even in part.

Three cases out of four were set; one of 3½ months' standing was resected on account of changes of the cartilaginous cover of the acetabulum and of the head.

Luxatio Obturatoria.—Access to the acetabulum is covered by the point of the trochanter and the before-mentioned muscles. These are to be pulled downward. The acetabulum is then emptied. Access to the head is blocked by the trochanter major, but is made possible by flexion and inward rotation. If the head is fixed firmly, an incision should be made from below directly to the head and the latter liberated from its adhesions through this incision. The incision should be sutured without drainage on account of the vicinity of the anus.

Then reposition should be performed as in the case of luxatio sciatica.

Two cases out of five were resected. In one case only osteotomy was performed. In this case hard, large masses of callus were present. In two cases reposition was made.

Hence, of the 17 cases treated by arthrotomy, four were resected, on one osteotomy was performed and on 12 reposition. Only one case died on which resection had been performed. This case was complicated by fracture of the collum femoris and by the presence of a great amount of callus, from which a diffuse hemorrhage occurred during operation. Patient succumbed on the next day in consequence of anæmia. All others recovered.

In five of the 12 cases on which reposition was performed suppuration developed, on account of which the head was subsequently resected. In one case in which suppuration developed likewise, recovery took place later, but suppuration reappeared several times subsequently. In six cases immediate and permanent recovery took place *per primam intentionem.* The great number of suppurations was the consequence of the fact that in the first cases a long search was still necessary for purposes of orientation and that these operations were thus very much protracted. The same unsatisfactory conditions used to obtain with regard to inveterate luxations of the shoulder. Now that the reposition of any kind of luxation has become, so to speak, a schematic operation, because of our knowledge of the above-mentioned pathologicotopographical relations, it will certainly be possible to guard against sepsis.

The Final Results.—In October of last year all those who had been operated upon were summoned for examination. Of those whose wound had healed smoothly, only three appeared. A boy of 8 years with a luxatio iliaca of 3½ months' standing showed the best results. Three and a half years later all motions in the reset joint were just as free as in the sound one.

In the case of a man 52 years old whose luxatio iliaca was of 2 months and 1 week's standing, flexion was possible up to 85°, abduction up to 10°, inward rotation up to 20°, outward rotation, as in the case of the sound leg, up to 47°, 1¾ years after reposition. The motions within the limits required for walking were comfortably possible, and therefore the gait was normal.

In the case of a luxatio iliaca 1 month old, flexion was possible up to 140°, abduction and adduction only slightly, outward and inward rotation within about half of the normal limit 5 years after reposition. The gait of the patient was entirely normal.

But two patients came to the examination whose cases are extremely important. One was that of a man of 59 years whose luxatio iliaca of 9 months' standing had been set with block-and-pulley by the bloodless method 9 years and 8 months previously.

An arthritis deformans gradually developed. About half of the caput femoris has already been ground off. In walking he limps badly. The second case is that of a man of 42 years with luxatio pubica whose luxation of one month's standing was set 3 years ago by circumduction. Massage and gymnastics were begun at once. Three years later, when patient appeared for examination, the set joint was entirely stiff when flexed at an angle of 160° under slight abduction. An X-ray photograph shows the head in the acetabulum. On it a shadow 1 cm. broad due to osseous fibulæ connects the minor as well as the major trochanter with the pelvis.

Hence it is evident that ostitis deformans and also osseous stiffening may arise not only after bloody but also after bloodless reposition.

Dollinger declares himself to be a decided advocate of bloody reposition in the case of inveterate traumatic luxations of the hip-joint, as it has been greatly simplified by his investigations and has, in its essential features, become a schematic operation. The severance of the muscles and the exposition of the bone are unnecessary and should therefore be avoided.

EDITORIAL NOTE

THE INTERNATIONAL SOCIETY OF SURGERY.

THE announcement that the next meeting of the International Society of Surgery will be held in New York renders the character and work of this society of immediate interest to American surgeons.

The Third Congress of the society has recently been held in Brussels, under the Presidency of M. Lucas-Championniere of Paris. *The Journal de Medicine et de Chirurgie* for October 25, 1911, contains an account of the society and of its recent session, written by its President, which is the source of the information contained in the present note.

The International Society of Surgery is a society, the membership of which is restricted to a selected list of eminent surgeons from each of the States of Europe and of America. It differs in this respect from other well-known general congresses to which membership is open to all who may care to subscribe. The society was organized ten years ago to meet every three years.

Dr. Championniere states that Dr. Keen, of Philadelphia, had been one of the most influential advocates of the organization of this society. Of the various motives which prompted him to advocate the creation of this society, the following were particularly taken into consideration, viz: That after having taken part in the great general international congresses, it had seemed to him that surgery was somewhat lost in them and that, as these congresses were open to all, a large number of various communications, emanating often from physicians of little surgical experience, or being published with an object hardly scientific in character, were admitted and the seances were prone to be embarrassed to such a degree that the over-weighted programs of these congresses could not be carried out. In fact, together with publications of the highest value, were to be found many dictated to secure some personal end, rather than to make known true scientific progress. Dr. Keen found many to share his opinion among those from all countries who had frequented the great congresses. He found especially a large number of the members of the Surgical Society of Belgium quite ready to second him in the formation of an International Surgical Society, especially M. Verneuil, who was the first Secretary General of the society; and M. Willems, of Gand, who has been the President of the International Executive Committee of the society. Also M. Depage, who, after having been during two sessions a most active Secretary General of the society, and after having given an extraordinary impulse to the development of the society and having contributed brilliantly to the success of its meetings, has just been nominated President for the next meeting, and finally, M. Mayer, who after having given most valuable assistance to M. Depage, has just succeeded him as Secretary General. Nor should M. Lorthioir, the Treasurer, be overlooked, who has fulfilled his difficult task with great assiduity and abundant success.

The number of members assigned to each country is not very great, compared to the number of surgeons in such countries, and new nominations can be made only to fill the places of members deceased or who may have resigned. Nominations are made for presentation at a general assembly of the society in congress, by the voice of the members of each nationality present.

The President of the society at its first session was Professor Kocher, of Berne; the second was Professor Czerny, of Heidelberg. At the last session the President was M. Lucas-Championniere. These three sessions have all been held at Brussels. The next session will be held in New York in 1914, under the presidency of Professor Depage, of Brussels.

At these congresses individual communications are not made according to the pleasure of each. Important questions are determined upon in advance. Reporters upon these questions are nominated from different countries and the discussions are allowed only upon those questions. This manner of organization has for its end to bring before the society the study of certain great questions set forth in the program, and the prevention of any undue diversion of the attention of the society by allowing matters of a multiform variety to be discussed. Nevertheless, at the two last sessions in order to give a greater variety to the materials presented, an exposition of pathological specimens has been added by the committee to the questions permitted in the general assembly. The first exposition conducted under the inspiration of Dollinger of Budapest was consecrated to cancer. During the last session, an exposition pertaining to fractures was highly successful and at the next, will be organized an exposition devoted to prothesis after amputation.

The questions to be considered at the New York congress will be: (1) The Surgery of Gastric and Duodenal Ulcer; (2) Grafts and Transplantations of Organs; (3) The Technic of Amputations; (4) The Treatment of Tetanus.

At the congress just passed the questions were as follows:

(1) Pulmonary Surgery; (2) The Diagnosis and Treatment of Colitis; (3) Pancreatitis.

Among those selected to report upon the first series was the late Dr. Ferguson, of Chicago. His paper upon "Parasites and Tumors of the Lungs" was completed by him shortly before the development of the illness which prevented his attendance at the congress, which illness terminated fatally at nearly the time when he should have presented his paper.

Among those selected to present papers treating upon the subject of the second class was Dr. Gibson, of New York, to whom was assigned the theme of "Surgical Treatment of Colitis." The paper by Dr. Gibson appears in another portion of the present number of the ANNALS OF SURGERY.

The papers upon pancreatitis were by Dr. Michel, of Nancy, Dr. Giordano, of Venice, and Dr. Körte, of Berlin. Of these papers very great importance must attach to the observations of Dr. Körte, whose paper may also be found in the preceding pages of the present number of the ANNALS OF SURGERY.

Dr. Lucas-Championniere speaks particularly of the great hospitality exhibited by the Belgians at the meetings which have thus far been held at Brussels. In addition to special receptions of many kinds, Prince Albert, the actual sovereign of Belgium, opened the first session of the congress in 1908, and at the last session the Minister of the Interior presided. The Burgomaster of Brussels, M. Max, also honored the seance with his presence, and later received the society at the wonderful Hotel de Ville of Brussels. Such fêtes given to a society whose numbers are restricted have a tendency to very closely bring together the surgeons from every country. Besides this, the number of ladies participating in these fêtes and at the public meetings has been considerable and has lent a peculiar attractiveness to them. These reunions have certainly contributed to progress, for it is of great advantage to know personally those whose writings one has read or whose practice one has occasionally met with. Dr. Championniere adds that he believes his own personal education has been greatly indebted to relations thus established, and he extends the wish that the success of the International Society may for the future increase opportunities for personal acquaintance among surgeons of every nationality.

Lewis S. Pilcher.

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ORIGINAL MEMOIRS.

PARATHYROIDS AND THEIR SURGICAL RELATION TO GOITRE.*

BY CHARLES H. MAYO, M.D.

AND

BERNARD F. McGRATH, M.D.,

OF ROCHESTER, MINN.

DURING the past several years the parathyroids have been studied by various methods, and, although our definite knowledge of their physiologic function and pathologic importance is limited, to-day we are justified in saying that these little glands are concerned in the metabolism of the body, and, consequently, that disturbances of them are of serious interest to both the internist and the surgeon. But, what seems to be the natural course in matters medical, the parathyroids, once recognized, became the object of numerous hypotheses. Theories have been advanced and diseases attributed to these structures without having the support of scientific investigation. Erroneous deductions have been made from defective experimentation, histologic conditions overlooked, and the findings misinterpreted. Illogical conclusions have been based on the administration of therapeutic agents, as, for example, the failure of parathyroid extract to control the attacks of tetany. However, recent and more exact methods of examination have dissipated many of those erroneous views and caused our minds to be focussed upon something definite.

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*Read before the Southern Surgical and Gynæcological Society, December 14, 1911.

There no longer seems to be substantial grounds for doubting the etiologic relationship between the parathyroids and one disease, namely tetany.

Experimental tetany has been produced in animals by the removal of parathyroidal tissue, and experimental tetany may be reckoned, in a certain sense, tetany following operation upon the human thyroid gland.

Histologic investigations of recent times have not only confirmed the results of experimental work, but also demonstrated that *spontaneous tetany* is caused by an *hypoplasia* with resultant *insufficiency* of the parathyroids. Therefore, in this paper we shall discuss these glands in their relation to the disease of tetany, but, before considering the *surgical* aspect of the subject, we shall briefly review some of the later works on the *spontaneous* form of this disease.

Tetany manifests itself by spasmodic attacks, which usually occur bilaterally, are often associated with intense pain, sometimes with slight œdema of the face, hands, and feet, and the latter have a tendency to assume a partial equinovarus position. In the *interval* between the attacks, the principal diagnostic points are *Trousseau's sign*, a peculiar tonic spasm of the fingers and thumb, the so-called *obstetric hand*, produced by prolonged, severe pressure upon the nerve-trunks, particularly the median nerve; *Chvostek's sign*, twitching of the facial muscles, elicited by tapping upon the trunk of the facial nerve, upon the malar bone, or over the infra-orbital foramen; *Erb's sign*, galvanic hyperirritability of the muscles, which contract to very weak currents; *Hoffman's sign*, extreme sensitiveness to the induced current.

Whereas *spontaneous* tetany is mostly observed in the child, yet attacks occur in adult life, and among these are cases of *tetania gravidarum*. Pathologic examinations seem to have proven that hemorrhages in the parathyroids have a positive significance in the causation of tetany, especially the tetany of childhood, and that these hemorrhages produce their effect by injuring the parathyroidal tissue, inhibiting its development, and, consequently, decreasing its functional power. Haberfeld has recently reported six cases of undoubted *tetania infantum,* whose parathyroids showed hemorrhages, which manifested themselves partly as blood-cysts and partly as old hemorrhages with hæmatogenous pigment. It has not been possible to positively fix the exact time of the bleeding, but many points favor Erdheim's view, namely, that it takes place during labor. In support of this opinion are very young cases (four weeks, four months old), presenting *old* hemorrhages, and the fact that the parathyroids are not disposed to bleeding, so that the mechanism of labor with its associated trauma can very likely play an important part. The explanation has been advanced that in extreme flexion of the child's head the chin presses upon the region of the parathyroids, and thereby injury is produced.

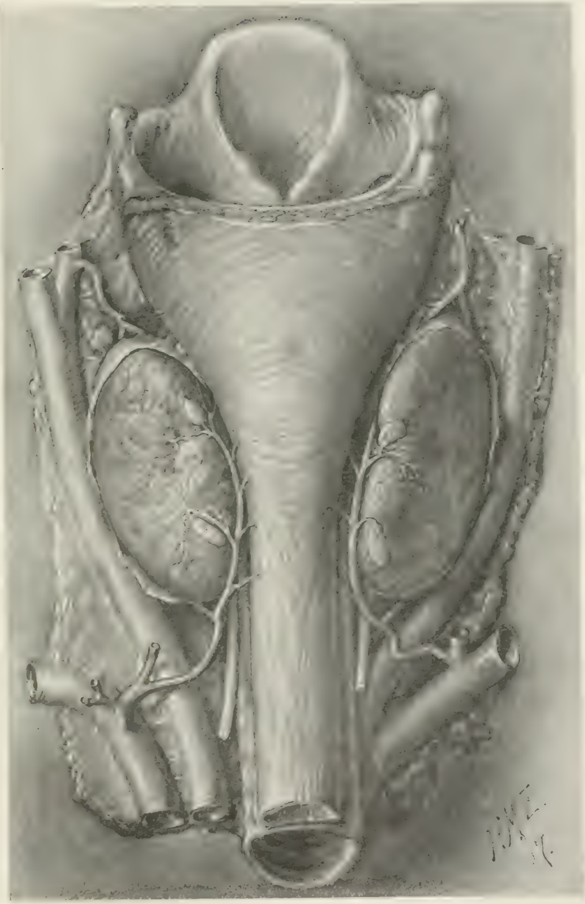
In this connection another point of interest has been revealed. Several of Haberfeld's cases showed absence of valves in the veins of the affected parathyroids, while the valves were present in the glands which were intact. Therefore, deficiency of venous valves has also been considered by recent investigators as contributing to the occurrence of these hemorrhages, since it is maintained that in the presence of increased blood-pressure these valves are a safeguard against bleeding. It has been suggested that these hemorrhages in the parathyroids are the *effects* of the convulsive attacks and *not* the *cause* of the tetany. Cases have been reported in which autopsy revealed not only hemorrhages in these glands but also areas of recent bleeding in the pericardium and the pleuræ. However, special methods of examination positively proved that the hemorrhages in the parathyroids antedated the beginning of the convulsive seizures, consequently could not have been caused by them.

An objection that has been advanced against the hemorrhagic theory, and one that deserves discussion, is the fact that the attack of tetany does not occur at the time of bleeding, but instead manifests itself very often only after the hemorrhages have been completely healed. That injury of the parathyroids takes place when the bleeding occurs is to be admitted, and that tetany does not appear simultaneously with the injury are facts which seem to be grounds for rejecting this theory. Escherich explains this apparent contradiction as follows: The central nervous system of the new-born is so insensitive that the clinical picture of tetany cannot manifest itself, and that such manifestation is only possible beginning with the third month. Escherich's view seems to be supported by the facts that the brain of the fœtus contains the highest amount of calcium (Quest), and that here calcium decreases with advancing age. Sabbatini has demonstrated that cerebral irritability is lowered by an increase of calcium and raised by withdrawal of the same. Therefore, it is concluded, tetany does not occur at the time of bleeding, because at this period the brain's irritability is very slight, which is due to the presence of a larger amount of calcium.

With regard to the importance of calcium in the condition of tetany, the writers refer to the observations of MacCallum and Voegtlin. These investigators have undertaken a study of the calcium metabolism of animals, in which this disease is produced by parathyroidectomy, and are endeavoring to demonstrate the relation of various salts, especially those of calcium, to experimental tetany. They state that all violent symptoms produced by parathyroidectomy—muscular twitching and rigidity, tachypnœa, fibrillary tremors, increased rapidity of the heart-beat, etc.—may be almost instantly cured by the intravenous injection of a solution of a calcium salt. The acetate or lactate in 5 per cent. solution is usually employed. Subcutaneous injection or the introduction of the solution into the stomach is quite as effective, but acts more slowly. The results from the use of magnesium are similar, but its otherwise bad effects contraindicate its employment.

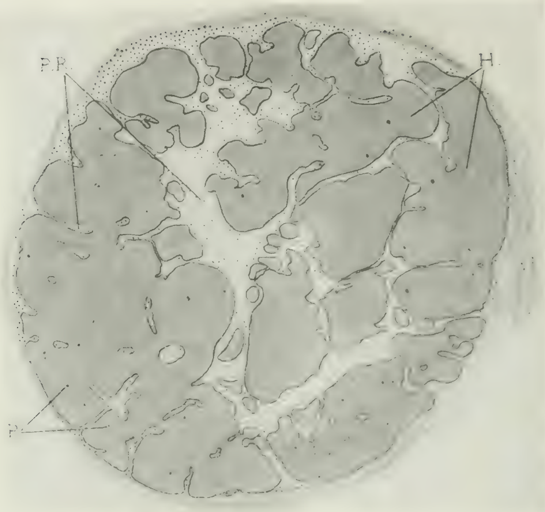
The condition of relief following the administration of these various salts lasts for perhaps 24 hours, when tetany

FIG. 1



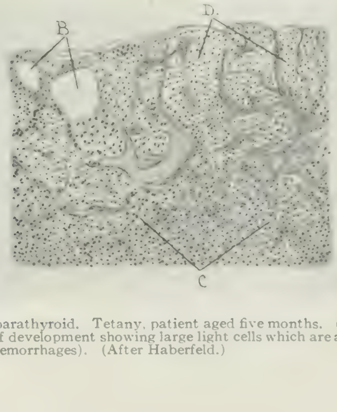
Parathyroid glandules.

Fig. 2.



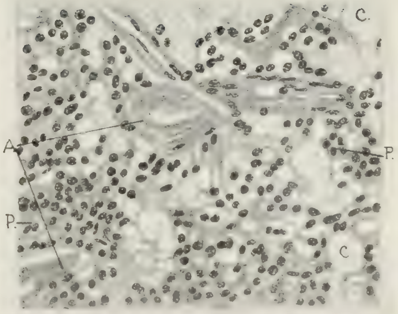
Cross-section through right superior parathyroid. Tetany, patient aged five months. Almost entire parathyroidal tissue destroyed by enormous hemorrhages. *H*, remains of parenchyma in the centre and as septa between the blood cysts, *P.R.* Many phagocytes (*P*) with pigment in the blood cysts, consequently signs of old hemorrhages. The zone of development completely absent. (After Haberfeld.)

Fig. 3.



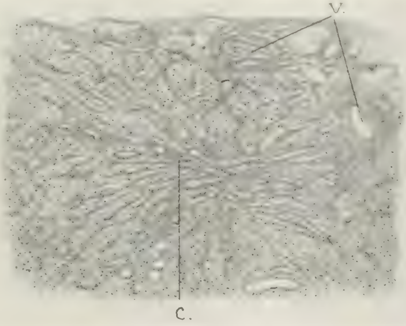
Small area of a parathyroid. Tetany, patient aged five months. *C*, small dark cells of the centre; *D*, zone of development showing large light cells which are absent at *B*, replaced by blood cysts (old hemorrhages). (After Haberfeld.)

FIG. 4.



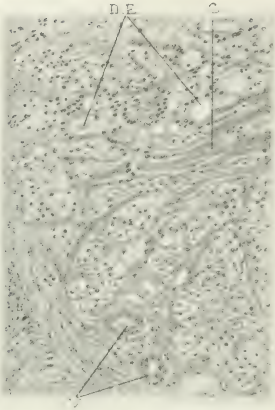
Tetany, patient aged 24 years. Amyloid degeneration of small vessels. *A*, cells near vessels show hydropsical degeneration, absence of nuclei, and swelling of protoplasm; *C*, loss of cell membrane with cavity formation; *P*, normal appearing parathyroidal cells. (After Haberfeld.)

FIG. 5.



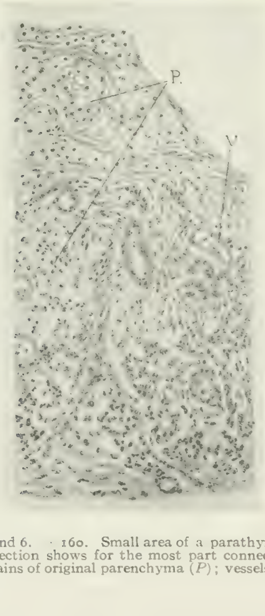
Tetania gravidarum. Patient aged 31 years. × 50. Area of a parathyroid showing moderately large, radiating cicatrix (*C*); vessels (*V*). (After Haberfeld.)

Fig. 6.



Same case as Fig. 5. × 125. Part of the cicatrix (*C*) is seen. Individual epithelial cells in this region swollen in place uniting and forming small cavities (*D.E.*). Vessels (*V*). (After Haberfeld.)

Fig. 7.



Same case as Figs. 5 and 6. × 160. Small area of a parathyroid which is almost completely atrophied. The section shows for the most part connective-tissue bands bearing many small vessels. Remains of original parenchyma (*P*); vessels (*V*). (After Haberfeld.)

may reappear. Analysis of the blood taken from a dog during tetany shows a calcium content which is only about half that of the normal dog on the same diet. These writers state that from their observations up to the present it is possible to construct at least a plausible, working hypothesis by which to explain their results. Apparently the parathyroids control in some way the calcium metabolism, so that upon their removal a rapid excretion, possibly associated with inadequate absorption and assimilation, deprives the tissues of calcium salts. In the case of tetany the central nervous system seems to be especially affected, as has been demonstrated by experiments in which muscles isolated from the central nervous system presented no twitching during the attacks.

However the salts of calcium and other salts may be concerned in maintaining a state of equilibrium in the function of the nervous system, and whatever may be the relation of the parathyroids to calcium and other metabolism, recent investigators state that all their experiences with tetany have shown that *insufficiency of these glands* is necessary for the production of tetany. This insufficiency occurs in experiments through removal of parathyroidal tissue; and in the *idiopathic tetany* of man it is caused by an hypoplasia of the parathyroids in consequence of pathologic processes.

In children there have been found hemorrhages, which, when they were relatively fresh and large (blood-cysts), presented evident severe injury of the parathyroids. But how is the insufficiency and therewith the tetany to be explained when even before the outbreak of the disease these blood-cysts have been gradually absorbed and only more or less blood pigment is to be found? As Erdheim has stated, by itself this pigment can scarcely produce injury of the parenchyma, but in spite of that fact it must be looked upon as the expression of a tissue injury which causes insufficiency of the parathyroids. Whereas it is not to be supposed that every hemorrhage in these glands produces hypoplasia, yet Yanase had never been able to demonstrate clinically normal galvanic irritability in any child whose parathyroids showed anatomically hemorrhages, even in slight amount.

Tetany is not to be explained alone by injury of parathyroidal tissue. There have been cases in which the glands were undoubtedly injured, that is, parathyroids disposed to tetany, but the attacks did not occur until another factor entered, for example, gastro-intestinal disease. Therefore, these patients lived for many years with defective parathyroidal tissue and were not seized with tetany until a contributing factor, whereby an excess of the toxic material was produced, caused hypofunction of the glands to be manifested. Beside the hypoplasia resulting from hemorrhages, other conditions have been noted in association with deficient development and insufficiency of the parathyroids. Haberfeld cites two cases of congenital syphilis, in which tetany developed and the parathyroids were shown histologically to be hypoplastic.

The same investigator was the first to examine the parathyroids in a case of tetany occurring in pregnancy. All four of the parathyroids showed pathologic changes, which included large scars, parenchymatous atrophy, and cysts. Therefore, basing their conclusions on experimental, clinical, and pathologico-anatomic investigations, recent writers state that the principal factor in the production of tetany is *insufficiency of the parathyroids.* This insufficiency may be either *absolute,* that is, referred alone to the glands, as by their absence (operative tetany), or relative, in which case the parathyroids are hypoplastic, consequently disposed to tetany, and hypofunction is precipitated by a contributing factor, as, for example, gastro-intestinal disease. The latter form seems from investigations to be the more frequent, and, for the tetany of children, is almost a law. Accordingly, injury of the parathyroids is to be regarded as disposing to tetany, while the releasing factor, whose nature still remains obscure, is undoubtedly of a very varying kind (infection, pregnancy, etc.). It is probable that the parathyroids, like other glands of the body, have factors of safety, which is somewhere between two and four times.

Surgical Importance of the Parathyroids.—Viewed in the light of all the experimental, clinical, and histologic works which have been done, these glands are to be regarded as structures possessing a function that is essential at least for the normal metabolism of the body. Although the results of animal experimentation are not uniform with regard to some points, yet they have proven that removal of parathyroidal tissue is usually followed by a symptom complex, which is termed *experimental tetany.*

Histologic examinations have shown pathologic changes in the parathyroids of typical cases of spontaneous tetany, and that these changes represent a *hypoplasia,* deficient development of the glands, which disposes to insufficiency of function, and also that these structural defects seem at times to be the result of trauma. Consequently, guided by these scientifically supported facts, the surgeon should scrupulously guard against removal or injury of the parathyroids. Remembering their variable size, location, and appearance, the operator should preserve all small, especially gland-like masses about the capsule in case of operation on the thyroid gland. If such a mass be accidentally removed in the course of operation, it should at once be implanted beneath some part of the remaining capsule. Probably the greatest danger is in operating upon both lobes at the same time or the second lobe at a later period. Furthermore, it should be borne in mind that parathyroidal tissue is sometimes present within the thyroid gland. Although rare in the human, this important observation has been made by Müller, Getzowa, Michard, Kloeppel, and others, and is to be considered in the presence of tetany following removal of thyroidal tissue, where the normal location of the parathyroids had been easily avoided. Beside the variability of the parathyroids in size, appearance, and location, another point of interest is to be kept in mind, namely, the observations of Vincent and Jolly on the relationship between parathyroidal and thyroidal tissue. These investigators state that the thyroid and parathyroids are morphologically and functionally related; that the parathyroids left behind after thyroidectomy can, under conditions, develop in the direction of thyroidal tissue, and that a functional replacement also takes place.

Assuming that relationship to exist, it is conceivable that in some cases manifestations, which are the sequelæ of parathyroidal disturbance, may follow operations upon the thyroid gland. On the other hand, considering the generally unstable metabolic equilibrium and the associated psychic disturbances of many patients suffering with hyperthyroidism, we should not be at first too greatly concerned over a post-operative tetanoid attack, since it is intelligible that such manifestations might be precipitated by operative procedure. A few such cases have been observed and considered probably hysteroidal in nature.

Treatment.—No reliable treatment for tetany is at present known, but the experimental works of MacCallum and Voegtlin, together with the clinical and histologic observations of Erdheim, Strada, Yanase, Haberfeld and others suggest certain principles to be followed. According to these investigations deficient parathyroidal tissue is the principal causal factor in the condition, and there seems to be a disturbance at least of the calcium metabolism. Consequently, the ideal treatment would be to compensate for this glandular deficiency by transplanting parathyroids from other individuals, feeding with animal glands, the use of serum or the extract of parathyroidal tissue. Unfortunately none of these procedures has given dependable results. In order to restore the balance in calcium metabolism, calcium salts, acetate or lactate, should be administered either intravenously, subcutaneously, by stomach, or by rectal enemata, the strength of dose varying with the mode of administration.

In order to avoid those factors which contribute to the attacks of increasing the toxic metabolic product, the patient's general condition, especially the gastro-intestinal tract, should be given most careful attention, to show that such condition is relatively uncommon following operation.

In 3203 operations on the thyroid gland in St. Mary's Hospital, the total number up to December 1, 1911, but one patient is known by us to have manifested signs suggestive of tetany, yet when such signs do appear we cannot but feel that the condition is due to some error in operative technic.

Case I.—G. H. S., female, aged forty-five years. Consultation Aug. 2, 1911. Clinical diagnosis, simple goitre. Family history, one sister had goitre. Personal history, two operations for lacerated perineum, last one eleven years ago. Sciatica, right leg, five years ago. Right lobe of thyroid gland enlarged for 25 years, left lobe for twelve years. Growing more rapidly the past three months, during which time the patient became nervous and suffered from dyspnœa. Rather despondent for last six months. No œdema. Able to do regular work up to present time. Operation, August 11, 1911 (St. Mary's Hospital), partial thyroidectomy, enucleation of cysts. Pathologic diagnosis, adenomata; cystic degeneration. Post-operative course: August 12, 1911, patient complained of stiffness in fingers and face, and tingling in legs. Fingers rigid and partially flexed at metacarpophalangeal joints, thumbs in palms; toes also flexed. August 13, 1911, patient complained of decided increase of symptoms. Treatment: 2.0 Gm. calcium lactate subcutaneously; thyroid extract. 0.30 Gm. every four hours for three doses; calcium lactate, 0.60 Gm. by mouth t.i.d. during the remaining time in hospital; trional, 0.60 Gm. at night. August 14, 1911, rigidity less and gradually diminished until the sixth day after operation, when it disappeared entirely. August 19, 1911, patient discharged from hospital.

It is questionable whether in this case genuine tetany was present, since some of the diagnostic points were wanting. The fact that symptoms subsided so soon after treatment might be suggestive, but a deduction from such unreliable premises would lead to error, especially since the signs did not reappear, and thyroid instead of parathyroid extract was used. Experimental evidence shows that, whereas tetany is relieved by the administration of calcium salts, yet the attacks tend to recur after 24 hours. Extract of thyroid gland was administered, but the indication for its employment is not supported by scientific investigation other than that the functions of the parathyroid and the thyroid seem to be interrelated. Even parathyroid extract has failed to produce effects in some cases of undoubted tetany (parathyroids removed at operation), although the treatment was continued for months.

Adhering closely to the view of parathyroidal causality in tetany, if the above was a genuine attack, either the parathyroids were already hypoplastic and rendered temporarily insufficient by the operative procedure and postoperative disturbances, or they were injured during operation, in which case an unusual location must be assumed, since only partial thyroidectomy and enucleation was performed on the thyroid gland of this patient. Finally, when the increasing nervous condition of the patient during the past several months is considered, the possibility of the manifestations having been hysteroidal in nature should be kept in mind.

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ARTERIOVENOUS ANASTOMOSIS—REVERSAL OF THE CIRCULATION—AS A PREVENTIVE OF GANGRENE OF THE EXTREMITIES.

REVIEW OF THE LITERATURE AND REPORT OF SIX ADDITIONAL CASES.

BY BERTRAM M. BERNHEIM, M.D.

OF BALTIMORE, MD.,

Assistant in Surgery, the Johns Hopkins University.

A DISCUSSION has arisen of late between Coenen of Breslau and Wieting of Constantinople as to the efficacy of an arteriovenous anastomosis—reversal of the circulation—in preventing the spread of a real or threatened gangrene in the extremity of a human. Coenen claims that Carrel's statements and experiments in regard to the possibility of reversing the circulation in the limb of a dog are not conclusive. That, in fact, the valves of the veins do not give way as asserted and that as a result a true and complete reversal is never attained, the blood simply being shunted off to another vein and promptly returned to the heart without ever getting to the foot or hand. Furthermore, he asserts that the procedure is both anatomically and physiologically wrong, and he therefore warns against the indiscriminate performance of this operation.[1]

Wieting on the other hand says that his clinical work, which has been highly successful, speaks for itself.[2] He admits that there are several questions, such as the return of the blood to the heart, still unsettled, but believes they will be solved only through clinical experience, theories and experimental work not having given the required solution.

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[1] H. Coenen and Wiewiorowski: Ueber das Problem der Umkehr des Blutstromes und die Wietingsche Operation, Beit. z. klin. Chir., Aug., lxxv, Nos. 1–2, pp. 1–473, also Cent. f. Chir., No. 29, 1911.

[2] Wieting: Treatment of Angiosclerotic Gangrene by Diverting Arterial Blood into Venous System, Deut. Zeit. f. Chir., cx, Nos. 4–6, pp. 313–634.

In view of the increasing number of successful reversals, it would seem that Wieting's stand-point is deserving of some support. Indeed, it would be a sad state of affairs if, after all the brilliant experimental work done in the field of vascular surgery, we should still hesitate to attempt the practical application of our knowledge.

A careful search of the literature has revealed forty-six cases of arteriovenous anastomosis—reversal of the circulation—in the human, to which I wish to add the following six cases, two of which were done on the same individual, though at different times.

CASE I.—H. L., colored, male, age twenty-seven. (From the wards of Dr. W. S. Halsted, the Johns Hopkins Hospital.) This patient came in complaining of a growth in the right popliteal space. At operation, January 21, 1910, by Dr. Halsted, the growth was found to be a sarcoma originating in the popliteal nerve and involving the popliteal artery and vein. A defect of about four inches between the ends of the vessels remained after radical extirpation of the tumor. Believing then that the lower leg was in danger, I was graciously allowed to remove about five inches of the left saphenous vein and transplant it between the severed ends of the right popliteal artery and vein; in other words doing a typical reversal. (The distal end of the artery was so small that it was thought best to use the vein as its lumen more nearly corresponded in size with that of the saphenous transplant.) Following operation there was an œdema of the lower leg, a dilatation of the superficial veins, and an elevation of temperature in the right leg as compared to the left. The leg continued to have a good circulation, and the patient left the hospital in good shape and able to walk. He died 18 months after operation. No autopsy was obtained, as death occurred at his home, but the probabilities are that the growth returned.

According to E. Wolff,[3] out of thirty cases of popliteal aneurism, gangrene in various degrees occurred in fourteen following extirpation. It is necessary therefore to consider this a doubtful case, inasmuch as the chances were about even that the leg would have lived had no transplantation been done.

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[3] Die Haufigkeit der Extremitatennekrose nach Unterbindung grosser Gefasstamme, Beit. z. klin. Chir., No. 58, 1908, p. 787-788.

Case II.—Miss M. G., white, age twenty-seven. Diagnosis Raynaud's disease. (Patient of Dr. J. C. Bloodgood, St. Agnes Hospital.) Five years ago the patient had a general infection from a wound on the index-finger. In May, 1910, she began to have pain in both feet, followed by some discoloration of the second toe of the right foot, necessitating removal of the toe. In January, 1911, two toes of her left foot became gangrenous and were removed. She constantly had pain in her legs, and her feet were always cold. On examination the pulse in the dorsalis pedis artery and the popliteal artery could not be felt in the left leg. The pain in this case was so severe and so constant that, believing the poor circulation had something to do with the condition, a reversal of the circulation in this leg was decided upon in the hope of giving relief. An end-to-end anastomosis between the femoral artery and vein in Scarpa's triangle was done on February 27, 1911. This being our first typical case, we made the mistake of cutting the vessels, vein, and artery at the same level and not allowing for the usual retraction following section of any vessel. It was not exactly a mistake either, because we started out to do a complete reversal, that is unite artery to vein and vein to artery, the latter to take care of the back flow. We did not know at that time, as we do now, that the complete reversal is all but impossible in the human without transplanting a piece of vein between one or the other of the vessels; nor did we know then, as we do now, that the complete reversal is unnecessary, because there are always enough veins in the limb to care for the back flow.

After trying for some time to bring the artery and vein together in spite of the retraction, we took about one inch off the upper end of the vein and transplanted it between the proximal end of the artery and the distal end of the vein, making a very satisfactory anastomosis. Following operation the pain gradually disappeared and now the left leg is apparently as good as it ever was. There is a powerful thrill to be felt and auscultated over the site of anastomosis and extending down to the knee.

For a time following this operation, strange to say, the patient obtained considerable relief in her right leg, and the dorsalis pedis and popliteal pulse, previously absent, could be obtained again. Gradually, however, the old pain recurred, the pulse was lost, and the foot began to get discolored in patches. The sciatic nerve was stretched, but only seemed to aggravate matters, in addition to giving the patient a foot-drop.

CASE V.—On May 27, 1911, therefore (10 days after stretching the sciatic nerve), a lateral anastomosis between the femoral artery and vein of the right leg according to the method of Bernheim and Stone,[4] was done, the vessels being exposed and sutured in Scarpa's triangle. The vein was tied off proximal to the site of suture to prevent back flow to the heart, but the artery was left intact. We considered this an improvement over the old end-to-end anastomosis, because it did not disturb the arterial circulation at all, but simply gave an added channel of arterial blood by means of the vein. The anastomosis has been perfectly satisfactory, as is evidenced by the thrill and pulsation over the site of anastomosis and the splendid circulation of the foot.

At this date, 11 months after the first and 7 months after the second operation, the left leg has a circulation apparently as good as normal and gives no pain. The right leg also has an apparently normal circulation, but there is still a foot-drop, anæsthesia of the muscles of the lower leg, and pain along the course of the sciatic nerve. This condition is slowly improving, and strong hopes of a complete recovery are held out by the neurologists.

CASE III.—M. R., white, male, age forty. (Patient of Dr. J. C. Bloodgood. St. Agnes Hospital.) Patient had been a sufferer from Raynaud's disease for nearly five years, having suffered extreme pain at times in all his extremities. The circulation in his right toes was very poor, and they became gangrenous, one by one, until all but the big toe had to be removed. He seemed to get along fairly well as regards his left foot, until March, 1911, when he came in with beginning moist gangrene of all the toes of this foot. The arterial tension was not increased. The urine was negative; the Wassermann was negative.

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[4] ANNALS OF SURGERY, October, 1911.

The usual remedies failed to check the gangrene or to relieve the pain, so it was decided to reverse the circulation in the limb as a last resort. The operation was done March 27, 1911, an end-to-end anastomosis being done between the femoral artery and vein in Scarpa's triangle. The artery seemed smaller than normal, even when distended with blood, and the fibrous sheath as well as the adventitia was more adherent and perhaps a little more dense than usual. The calibre of the vein was smaller than usual, though in other respects it seemed normal.

On the day following operation, the leg was quite œdematous, all the superficial veins were dilated, a popliteal pulse could be felt (it was absent before operation), and the patient seemed to have less pain, although the condition of the foot had changed little, if at all. After this, the pain gradually became worse and the gangrene progressed, so that three days after operation the leg was amputated at the thigh. At this operation the site of the blood-vessel anastomosis was exposed and found to be working beautifully.

Looking backward, it would seem that this case was badly selected and the blood-vessel operation ought never to have been done, because apparently the gangrenous process had progressed so far that the nerves had become involved as well as the smaller vessels, thus making an attempt at saving the limb utterly hopeless.

Case IV.—M. B., white, female, age sixty-one. (Patient of Dr. J. C. Bloodgood, St. Agnes Hospital.) This patient came in complaining of sharp pains and an extensive ulcer of her right foot, which had been present for about two and a half months. There was tingling and numbness, the skin was white and cold, and there were dark brown areas of gangrene from the toes to the ankle. The patient had a general arteriosclerosis, there was no sugar in the urine.

On March 27, 1911, the femoral artery and vein were exposed in Scarpa's triangle; on severing the artery preparatory to doing an end-to-end anastomosis, the vessel was found to be two-thirds occluded by an old thrombus; the vessel wall was quite thick and sclerotic. Although the outlook under such circumstances was very discouraging, the thrombus was pressed out of the vessel with the thumb and fore-finger and the usual end-to-end anastomosis done. The blood went over in the usual manner and continued to do so as long as the vessels were exposed. Following operation, although no pulse could be felt over the site of anastomosis and no thrill could be elicited by the stethoscope, the condition of the patient's foot gradually became better and the ulcers healed. Just before the patient left the hospital a faint pulse could be felt in the femoral vein below the site of anastomosis. The success of this case from an operative stand-point is naturally doubtful, but the circulation in the patient's foot and leg was so poor before operation that it seems that had the anastomosis been a complete failure, the foot must surely have become gangrenous.

Case VI.—W. L. B., white, male, age fifty-two. (Patient of Dr. J. M. T. Finney, at the Union Protestant Infirmary.) For about two years the patient had been suffering with severe pain in his left hand and arm, the fingers at times becoming quite cyanosed. He had had the tips of three fingers of this hand amputated because of gangrene. The other extremities were involved in a similar manner, but to a lesser degree, although the pain was so severe that the patient had become addicted to morphine. The patient had had a suspicious venereal sore and had been a heavy drinker; he had also had at one time, in 1900, a severe case of dysentery. There was a generalized arteriosclerosis; the urine was negative, the Wassermann was negative; no radial pulse was to be felt in the left wrist.

Under expectant treatment the patient improved for a time, but later on the condition in the left hand became so threatening that a reversal of the circulation in the upper arm was done in the hope of avoiding amputation. The operation was done on June 7, 1911. It had been our intention to do a lateral anastomosis, but on exposing the vessels the artery was found almost completely occluded by an organized thrombus. We therefore went above this thrombus and did an end-to-end anastomosis between artery and vein at the lower limit of the axilla. Following operation the patient's pain was completely relieved, the color in the arm and hand became far better than before operation, and motion in the fingers was considerably improved. No pulse, however, could be felt below the site of anastomosis, and the success of this operation from an operative stand-point is also in doubt. It is fair to state, however, that the vein branched immediately below the suture line and thus divided up the pulse considerably. In addition to this, the patient left the hospital in such good condition that it seems as if some blood must have been going down to the hand through the venous channels, otherwise gangrene must have ensued.

A list, then, of all the cases in the literature, including my own, will be as follows:

CASES OF ARTERIOVENOUS ANASTOMOSIS REPORTED IN LITERATURE.

Case 1.—San Martin y. Satrustegui: Male, 52; situation leg, for gangrene of foot; lateral anastomosis. Failure; amputation 6 days post-operation, death 13 days post-operation.

Case 2.—San Martin y. Satrustegui: Male, 75; situation leg, for gangrene of foot; lateral anastomosis. Patient recovered, although before operation gangrenous part removed. Case negative.

Case 3.—Jaboulay: Male, 47; situation leg, for beginning gangrene; lateral anastomosis. Failure.

Case 4.—Jaboulay: Male, 67; situation leg, for threatened gangrene. Failure; amputation 4 days post-operation, death 6 days post-operation.

Case 5.—J. C. Hubbard: Male, 80; situation right leg, for beginning gangrene; artery invaginated into vein. Unimproved; amputation.

Case 6.—H. Lilienthal: Male, 20; situation left leg, for beginning gangrene; end-to-end. Death 31 hours after operation, shock.

Case 7.—C. A. Ballance: Female, 75; situation right leg, for beginning gangrene. Successful; patient died 5 months after operation of gangrene of the large intestine. No autopsy.

Case 8.—Wieting: Male, 40; situation left leg, for threatened gangrene; intubation. Successful; patient discharged after 2 months, well.

Case 9.—Orhan: situation leg, for beginning gangrene; intubation of popliteal artery and vein. Failure; amputation.

Case 10.—J. C. Hubbard: Female, 60; situation leg, for beginning gangrene; artery invaginated into vein. Failure; amputation.

Case 11.—F. B. Lund: Male, 32; situation left leg, for threatened gangrene; end-to-end. Failure; amputation.

Case 12.—J. C. Hubbard: Female, 84; situation left leg, for beginning gangrene; end-to-end. Failure; death from senility 2 months after operation.

Case 13.—D. J. Armour and E. A. Smith: Male, 69; situation right leg, for threatened gangrene; end-to-end. Failure; amputation 2 weeks post-operation.

Case 14.—J. C. Hubbard: Male, colored, 77; situation right leg, for beginning gangrene; end-to-end. Temporarily successful; amputation 5 weeks post-operation because of pain and œdema.

Case 15.—G. P. Muller: Male, 51; situation left leg, for beginning gangrene; end-to-end. Failure.

Case 16.—Bier: Male, 38; situation leg, for beginning gangrene; intubation. Failure; amputation.

Case 17.—Payr: Male, 70; situation leg, for beginning gangrene; intubation; profunda artery intubated into femoral vein. Failure; death 16 days post-operation.

Case 18.—Abalos: Male, 62; situation right leg, for beginning gangrene; lateral anastomosis femoral artery and saphenous vein. Failure; amputation.

Case 19.—Imbert: Male, situation leg, for gangrene; lateral anastomosis, femoral artery and saphenous vein. Failure; death 2 days post-operation.

Case 20.—Celesia: Female, 52; situation leg, for gangrene; lateral anastomosis, femoral artery and vein. Failure; death 20 days.

Case 21.—Goldberg: Male, 64; situation leg, for gangrene; intubation. Successful, but death 15 days post-operation from erysipelas.

Case 22.—Jaboulay: Male, 66; situation leg, for gangrene; end-to-end. Failure; amputation.

Case 23.—Tuffier: Male, 50; situation leg, for threatened gangrene; end-to-end. Successful.

Case 24.—Imbert: Male, 25; situation leg, for popliteal artery and vein ruptured by lightning stroke; end-to-end anastomosis of popliteal artery and vein. Failure; amputation.

Case 25.—Tuffier: Male, 56; situation left leg, for beginning gangrene; lateral anastomosis. Failure; death.

Case 26.—Doberauer: Male; situation arm, for thrombus and threatened gangrene; invagination. Successful.

Case 27.—Tuffier: Male, 50; situation leg, for beginning gangrene; end-to-end. Successful.

Case 28.—Lacroix: Male, 25; situation leg, for gun-shot wound; end-to-end. Failure; amputation.

Case 29.—Schmeiden: Female, 48; left leg, for gangrene; end-to-end. Death 24 hours post-operation.

Case 30.—Enderlen: Situation leg, for threatened gangrene; end-to-end. Failure; amputation.

Case 31.—Enderlen: situation leg, for beginning gangrene; end-to-end. Death 3 days post-operation.

Case 32.—Goyannes: situation leg, for aneurism; end-to-end. Successful.

Case 33.—Kruger: Female, 48; situation right leg, for beginning gangrene; intubation. Failure; amputation.

Case 34.—Tietze: Female, 69; situation leg, for gangrene; intubation. Failure; death 19 days post-operation.

Case 35.—Tietze: Male, 64; situation right leg, for gangrene; intubation. Successful, but death from erysipelas 15 days post-operation.

Case 36.—Payr: Male, 70; situation leg, for beginning gangrene; profunda artery intubated into femoral vein. Failure; death 16 days post-operation.

Case 37.—C. Beck: Male, colored; situation right leg, for gangrene; lateral anastomosis. Failure; amputation.

Case 38.—Wieting: Male, 40; situation right leg, for threatened gangrene; lateral anastomosis. Successful.

Case 39.—Orhan: Male, 40; situation left leg, for gangrene; intubation. Failure: amputation.

Case 40.—Wieting: Male, 33; situation left leg, for beginning gangrene; lateral anastomosis. Temporarily successful; amputation 3 months post-operation.

Case 41.—Wieting: Male, 35; situation right leg, for threatened gangrene; intubation. Successful; although half of foot had to be amputated.

Case 42.—Wieting: Male, 32; situation left leg, for threatened gangrene; lateral anastomosis. Successful.

Case 43.—E. Heymann: Male, 47; situation left arm, for beginning gangrene; end-to-end. Successful; patient well 11 months post-operation.

Case 44.—Quenu: Male, 48; situation left leg, for Raynaud's disease; end-to-end. Temporarily successful; amputation 4 months post-operation.

Case 45.—Coenen: Male, 51; situation right leg, for beginning gangrene; end-to-end. Failure; amputation 4 days post-operation.

Case 46.—Glasstein: Male, 38; situation right leg, for threatened gangrene; end-to-end. Successful.

Case 47.—B. M. Bernheim: Male, colored, 27; situation right leg, for sarcoma of popliteal space necessitating resection of popliteal vessels; end-to-end. Doubtful; death from metastases 18 months post-operation.

Case 48.—B. M. Bernheim: Female, 27; situation left leg, for Raynaud's disease; end-to-end. Successful.

Case 49.—B. M. Bernheim: Female, 27; situation right leg, for Raynaud's disease; lateral anastomosis. Successful.

Case 50.—B. M. Bernheim: Female, 61; situation right leg, for beginning gangrene; end-to-end. Successful.

Case 51.—B. M. Bernheim: Male, 40; situation right leg, for Raynaud's disease; end-to-end. Failure; amputation 3 days post-operation.

Case 52.—B. M. Bernheim: Male, 52; situation left arm, for threatened gangrene; end-to-end. Successful.

In studying these 52 cases I find that 38 were done on males, 10 on females, and in 4 the sex was not stated. The ages varied all the way from 20 to 80 years. Fifteen out of the 52 cases must be considered successful ones, that is, cases in which the reversal, as far as one can judge, actually saved the limb from real or threatened gangrene—a percentage of 30 per cent. I have included Case 7 among the successes, because death was in no way related to the vascular condition in the leg, but I have thrown out Cases 14, 40, and 44 because, though apparently successful as far as the actual operation was concerned, an amputation later on became necessary. Case 47, as said above, I consider doubtful, and Case 2 negative.

Among the failures there were 13 deaths; 2 from shock and 11 from senility and erysipelas. Most of these patients were in a desperate condition physically at the time of operation, thus rendering an operative procedure precarious to say the least.[5] It is difficult to see how the operation of reversal of the circulation could have contributed any more to the cause of death than any other operative procedure that may have been performed on the limbs of the same individuals. Just why there should have been so many cases of erysipelas is a mystery to me, unless it can be laid to the door of faulty technic. It has not occurred in my own series of cases.[6]

In the remaining 22 cases the course of disease was uninfluenced by the reversal, although there was a temporary improvement in several cases. Amputation was performed in each instance.

The operation was done twice in the upper extremity, once for thrombus and threatened gangrene, once for threatened gangrene, both times successfully. The remaining cases were in the leg, the operation being done four times for Raynaud's disease, once for sarcoma of the popliteal space, which necessitated removal of about four inches of the popliteal artery and vein, once for aneurism, once for rupture of the popliteal artery and vein, once for gun-shot wound, and the remainder for real or threatened gangrene.

As to methods of operation, the end-to-end suture of Carrel and Stich was done 23 times with 8 successes, lateral anastomosis 12 times with 4 successes, invagination (end of artery into end of vein) twice with 1 success, and the intubation of Wieting (end of artery into side of vein) 9 times with 2 successes. The method was not stated twice and one of these operations was successful.

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[5] In a personal communication to Coenen, Gottstein said that he had done three cases of reversal, with death in each case.

[6] It is interesting to note that in the last 16 cases there have been no deaths, and that of these cases 9 were successful, 5 unsuccessful, and 1 doubtful.

I believe, and Wieting also seems to lean toward a similar belief, that in the future the method of choice for reversal will be a lateral antastomosis, and in conjunction with Stone[7] have advocated a method whereby the artery and vein are incised transversely through one-third of their diameter and then sutured. Following the suture and before turning on the blood stream, the vein is tied off proximal to the site of anastomosis to prevent back flow to the heart. The flow through the artery is not interfered with whatsoever, the only thing that happens being an added arterial channel through the vein. In this way the artery will continue to carry nourishment as far as it is patent, while the vein will supposedly carry it to the foot or hand. Should a thrombus occur at the site of anastomosis, it will form in the side of the artery (as we have proved experimentally) and the limb will be no worse off than before. On the other hand, in the event of success, the limb will have an abundant supply of blood. I have so far done this operation once clinically (Case 49), and have been very much gratified at its success. Wieting did a somewhat similar operation in Cases 38, 40, and 42, the first and last being successful.

Just how far down the vein the blood will go is a question that can be decided only by clinical cases. That the arterial pressure will force the blood beyond the valves of the femoral vein in a dog I have demonstrated experimentally, as well as Carrel, and I am firmly convinced that a similar phenomenon takes place in the human. To say that Wiewieorowski was unable to inject the veins of a cadaver from above and that, therefore, a reversal of the circulation in a limb is impossible, shows a lack of understanding of conditions as they are in the living.[8] The constant pounding of the arterial blood against the valves of the vein gradually wears them down and forces them to give in the dog; why cannot a similar condition take place in the human? I believe it does, just as the constant pounding of the surf wears down the hardest rock, just as the fearful pounding of a thoracic aneurism at times slowly but surely wears away a man's vertebræ.

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[7] ANNALS OF SURGERY, October, 1911.

[8] Coenen and Wiewieorowski have only done one case in the human and that was unsuccessful.

But as Wieting says, success is the best of all refutations, and as time goes on the successful cases will increase in number. In the past, the cases have not been selected with sufficient care. It is obviously impossible to bring the dead back to life, yet that has all but been attempted. Around every fulminating gangrenous area the neighboring vessels, veins as well as arteries, are partially or wholly thrombosed. If this condition prevails only to a slight degree, well and good, but if it is extensive, if all the toes, or half the foot, or all the foot is involved, to do a reversal is only inviting failure. The cases must be gotten before the gangrene arises. If this is impossible, it is best to let the process subside or localize and then do a reversal in the hope of preventing further encroachments. The age of the patient has little or nothing to do with the question, but rather the age and condition of his vessels.

Another most important factor to be considered is the skill and experience of the operator. It is my belief that the frequent failure following reversal of the circulation in the past has been due not so much to the failure of the valves of the veins to give way as to a thrombus at the site of anastomosis—in other words, to a faulty technic in the suture. Animal experimentation and lots of it is an absolute necessity to the surgeon who wishes to do clinical work in the field of vascular surgery. Too much stress cannot be laid upon this point, and a more general observance of it can but bring better results.

It is indeed a great pleasure to be able to acknowledge my indebtedness to Dr. W. S. Halsted, Dr. J. M. T. Finney, Dr. J. C. Bloodgood, and Dr. Harvey Cushing. Without their aid and kindly sympathy neither the experimental nor the clinical work which forms the basis of this paper could have been accomplished.

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NOTES ON THE TECHNIC OF SUTURING BLOOD-VESSELS WITH A NEW INSTRUMENT.*

BY J. SHELTON HORSLEY, M.D.,

OF RICHMOND, VIRGINIA

The history of successful blood-vessel suturing goes back only a few years. In no department of surgery is success so dependent upon an accurate following of technical detail. The slightest break in asepsis, any undue roughness in handling the vessels, or the lack of mechanical accuracy means either immediate failure or else clotting and obstruction of the lumen of the vessel soon after the operation has been completed. The development of this distinctive branch of surgery has been fully described by Watts,[1] and more recently by Ehrenfried and Boothby,[2] and Winthrop.[3] Carrel's work in demonstrating, in 1902, the essential features in suturing blood-vessels is the real beginning of successful surgery in this field. He showed that strict asepsis, the utmost gentleness in handling the vascular endothelium, and accurate approximation of intima to intima are prime factors in suturing blood-vessels. He called attention to the fact that, aside from immediate failure, remote clotting was due to some technical error, as wherever the endothelial cells of the intima are injured, either by trauma or by drying, clots sooner or later are very likely to occur.

It is the general opinion among surgeons that the suturing of blood-vessels is exceedingly delicate and may be done only by a favored few. In this way its usefulness has been curtailed. for emergency surgery, such as stab and bullet wounds of the vessels, furnishes the most fertile clinical field for this work, and those who do much emergency surgery are the very men who should be competent to suture blood-vessels. Any effort to simplify the technic should therefore increase the clinical usefulness of this procedure. In experimental work, after the general principles are mastered, such as placing the sutures and careful handling of the intima, the most prominent difficulty is managing the guy sutures. The necessity for changing hands and transferring guy sutures after suturing each third of the vessel, the chances of their being tangled, the maintenance of proper tension on the guy sutures, and the relaxation of the tension while changing from one-third of the vessel to the other, are likely to be confusing and to make the sutures irregular and faulty. Another very practical objection is the difficulty in obtaining the services of an assistant trained in this work at just the time when such help is most needed.

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* Read by title at a meeting of the Southern Surgical and Gynæcological Association, Washington, D. C., Dec. 12, 13, and 14, 1911.

[1] Bulletin of Johns Hopkins Hospital, 1907, vol. xviii.

[2] ANNALS OF SURGERY, Oct., 1911, 485.

[3] Southern Medical Journal, Nov., 1911, 760.

In order to avoid these difficulties and in an effort to simplify the technic, I have used an instrument for holding the guy sutures in position. This instrument (Fig. 1) consists of a small steel shaft about one-sixteenth of an inch in diameter, which curves at one extremity into a shorter shaft. The long shaft or handle is six inches long, and the short shaft is one and three-quarter inches long. The short shaft is placed at an angle of 55 degrees to the long shaft. The curved portion is flattened out quite thin so as to form a light spring. There are five buttons, one on the main shaft as close as possible to the curve, one at the extremity of the short shaft, one a half inch below this, and two on the main shaft at points about opposite the buttons on the short shaft. All of these buttons hug the instrument closely and are so constructed that the guy sutures are held securely by merely wrapping them twice around the buttons.

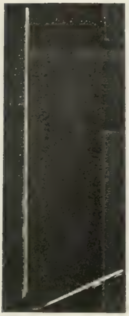
The technic of suturing blood-vessels with the use of this instrument is as follows:

The vessel is exposed and clamped on each side of the operative field with rubber covered Crile clamps. It is divided with sharp scissors, and the adventitia is pulled down over each end of the vessel between the finger and thumb and cut squarely off.

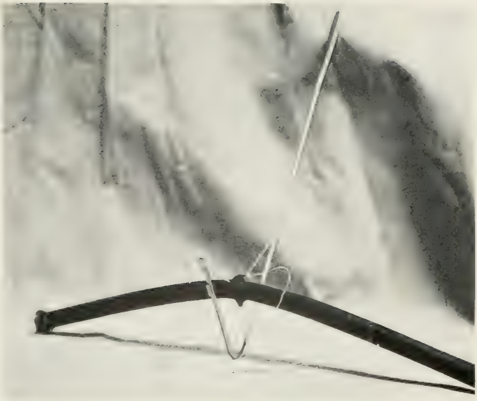
The ends are washed out with salt solution in a medicine dropper. The ends of the vessel are then smeared with warm vaseline and three guy sutures are placed with a No. 16 straight needle and fine black silk. I untwist No. 1 black Chinese twisted silk into three strands and use these for sutures. After threading, the strand is secured in the needle by a single knot. The thread must be thoroughly anointed with vaseline before being used or may be boiled in vaseline. Three guy sutures divide the vessel's circumference into three equal parts and are passed by going from without inward near the end of the vessel, the point of the needle emerging from the intima. The needle is then carried to the other end of the vessel, which it penetrates in a reverse direction, that is, from within out, entering on the intima. These guy sutures are tied as they are inserted, using the ordinary knot. The ends of the suture are held taut while running down the second turn of the knot so as to prevent the first turn from slipping. The instrument above described is then placed under the artery with the short shaft toward the operator, and the bottom guy suture is wrapped twice around the lowest button on the main shaft. The ends of the suture are then cut close to the button so as to be rid of unnecessary thread. The upper guy suture nearest the main shaft is fastened by taking the end of the suture without the needle (the short end of the suture) and wrapping it around one of the two upper buttons on the main shaft. In vessels of ordinary size the lower of these two buttons is used. The end of this suture that is threaded is not cut, but is left for future suturing. The third guy suture is wrapped twice around one of the buttons on the short shaft while this shaft is very slightly pressed toward the main shaft. When this pressure is released, tension is placed on the three guy sutures, and the circumference of the blood-vessel is pulled from a circle into a triangle and held rigidly in this position (Fig. 2). The suturing begins at the upper guy suture on the main shaft, that is, the upper guy suture farthest from the operator. The instrument is held with the handle vertical, and the long end of this guy suture, which has been left with the needle attached, is passed back and forth through the slightly everted lips of the upper third of the margins of the artery, after the manner of a continuous mattress suture (Fig. 3). The instrument is slightly elevated during this suturing, which still

Fig. 2.

Fig. 1.

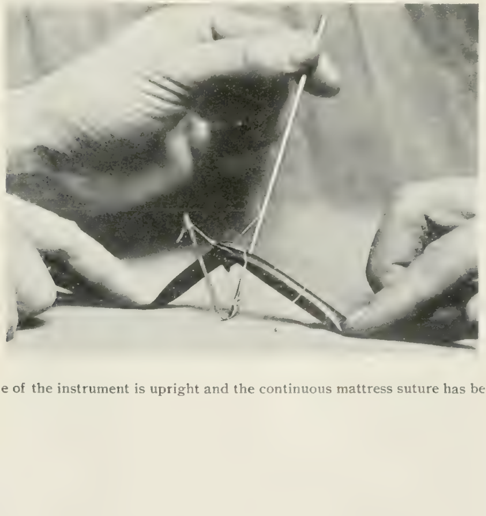


The instrument for holding the guy sutures, as described in the text.



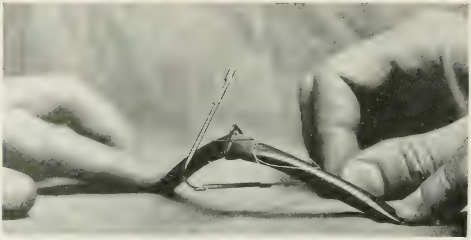
A thin rubber tube representing an artery with the three guy sutures placed and fastened to the buttons on the instrument. The circumference of the tube is made triangular by the tension of the guy sutures.

Fig. 3.



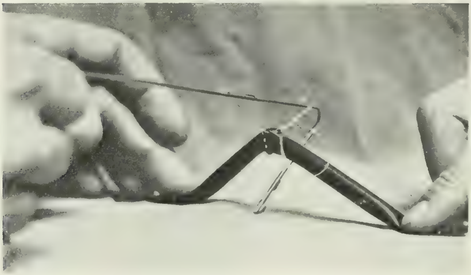
The handle of the instrument is upright and the continuous mattress suture has been started.

FIG. 4.



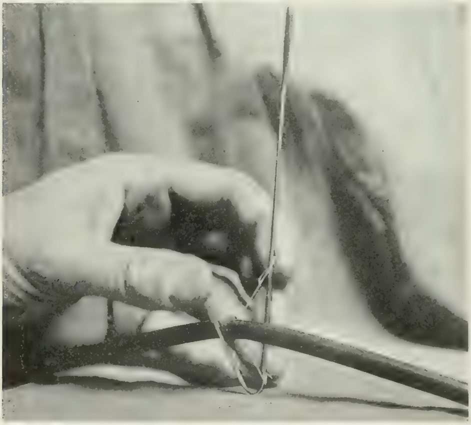
The handle is depressed till it is horizontal and points away from the operator. The second division is being sutured.

FIG. 5.



The handle of the instrument is depressed till it is horizontal—this time pointing toward the operator. The last division is being sutured.

FIG. 6.



The handle of the instrument has been brought to its original position and the suturing has been completed. The instrument is grasped between the thumb and fingers and compressed to relax tension of the guy sutures and demonstrate whether there is a spurting point along the suture line.

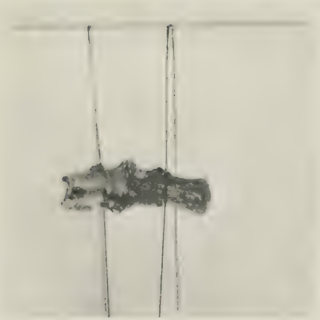
ERRATUM.

ARTERIAL SUTURING.

The illustration, Fig. 8, opposite page 211 of the February number of the ANNALS OF SURGERY, was reversed so that the legend below was incorrect. It should read:

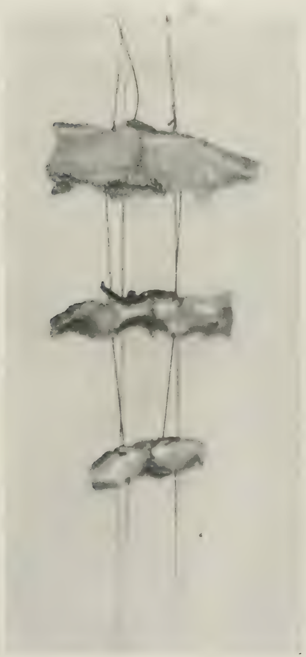
"Fig. 8.—Three specimens of arterial suture from dogs. The lower specimen was removed in a few minutes after operation, the middle specimen two days after operation, the upper specimen thirty-three days after operation. The two lower specimens are carotid arteries, the upper one is a femoral artery. For further description see text."

Fig. 7.



Specimen from transfusion of blood. To the right is the vein, to the left the artery. Note the small amount of thread exposed to the lumen.

Fig. 8.



Three specimens of arterial suture from dogs. The upper specimen was removed a few minutes after operation, the middle specimen two days after operation, the lowest one 33 days after operation. The two upper specimens are carotid arteries, the lowest one is a femoral artery. For further description see text.

further increases the eversion of the margins of the vessel and renders it possible to place the sutures more accurately. The suturing is done toward the operator, and constant tension is kept on the suture by holding the thread in the left hand and so bringing the thread down snugly after each suture is placed with the right hand. The sutures are close together. In the carotid of a medium sized dog, there should be about five or six sutures between each guy suture.

When the second guy suture is reached, the handle of the instrument is depressed away from the operator till it lies horizontal (Fig. 4) instead of vertical. The whole instrument should then be slightly shoved toward the operator, so as to increase the eversion of the intima in the third that is being sutured. The suture is continued along the second third of the vessel's circumference in the same manner as in the first, only care must be taken to place the suture at the angle well inside of the guy suture, as the latter may cut the vessel somewhat and so cause leakage, and also because the vessel wall is pulled out more markedly at this point, which makes it necessary to take a deeper bite here in order to secure uniformity in the line of sutures.

When the third guy suture is reached the position of the instrument is again changed, the handle or main shaft being depressed toward the operator (Fig. 5). The position of the instrument now is such that the handle points to the operator while suturing the last third of the artery, which is exactly the opposite direction to its position while suturing the second third. The whole instrument is gently elevated to increase the eversion of the margins of the artery. The suture is continued along the last third of the artery, and when the starting point is reached the instrument is brought to its original vertical position.

The suture is carried about two stitches beyond the starting point, and is there finished by whipping it over twice after the manner of an over-hand suture, and running the thread under the loop before the loop is drawn tight. This holds the thread securely. The Crile clamps are then loosened gradually, the distal one first. The shafts of the instrument are grasped between the thumb and fingers and pressed toward each other so as to relax the tension on the guy sutures (Fig. 6). If any spurting point occurs the clamps are reapplied, the pressure on the shafts is relaxed, and an extra suture is placed at the spurting point. This is rarely necessary in suturing arteries, though, where a segment of vein is grafted on an artery, a spurting point often occurs. If no point spurts, the guy sutures are cut close to the artery and the instrument is removed. The small amount of oozing immediately after the suturing is completed usually checks spontaneously, or at least after gentle pressure with dry gauze. If after slight pressure with dry gauze for a minute there is still any leakage of blood, a suture should be placed at the point of leakage. If too much pressure is made with gauze a clot may form. When the wound is closed the arterial suturing should be perfectly dry and free from any oozing of blood.

In discussing the advantages of this new method, let us first consider the merits of a continuous mattress suture in blood-vessel surgery. It is well known that in intestinal surgery the continuous mattress suture makes exceedingly smooth approximation on the peritoneal surface, and a minimum amount of thread is left exposed. In the case of a blood-vessel, the endothelial layer is on the inside of the vessel instead of on the outside, as in the intestine. The object in each instance is to approximate the endothelial surface, and by applying the continuous mattress suture, as recommended in the above technic, we obtain the same approximation and minimum exposure of the thread within the vessel as is seen on the serous surface of the bowel after the application of a continuous mattress or right angle suture. In blood-vessel suturing it is most desirable to have as little of the thread exposed to the current as possible, and this suture is more capable of fulfilling this requirement than any other continuous suture. In addition to this advantage, there is less likelihood of the vessel being cut with mattress stitches than with other forms of suture. This property of the mattress suture is recognized in general surgery and is utilized in sewing such tissue as muscles when cut transversely; where a single straight suture will cut out, the mattress suture, which grasps a loop of tissue at a right angle to the line of traction, will hold.

The advantages of the instrument have already been alluded to. Of course, to obtain satisfactory results it must be properly used. The guy sutures should be of about equal length from the buttons to the artery, so that no undue traction is made on any one suture. If the guy sutures are of equal length, the tension of all of them can be increased or diminished by regulating the suture that runs to the end of the short shaft. If the short shaft is pressed upon too forcibly when the last guy suture is applied, so much tension will be made that the guy sutures may cut the vessel wall unduly. This is very easily regulated, and when once the guy sutures are properly placed the tension all along the arterial wound remains exactly the same from the beginning to the end of the suturing. This insures uniformity of the sutures, and prevents the alternate stretching and relaxation that must occur every time the guy sutures are changed when they are held by hand. No skilled assistant is required, and in fact a blood-vessel can be sutured by the operator without any assistance at all, as he can hold this instrument in part of the left hand, while the thumb and index-finger of the same hand follow the thread as the sutures are placed. If a leak occurs it is easily demonstrated by loosening the clamps and relaxing the guy sutures by compressing the shafts of the instrument as described above (Fig. 6). The clamps are then reapplied and the leak accurately sutured with the vessel still held in the instrument. In this manner, any competent surgeon with some experience in experimental work on the arteries can confidently suture large vessels or perform transfusion of blood with a needle and thread. In both instances the same technic is used.

In transfusion of blood, where the artery of the donor is united to the vein of the patient, this method of suturing is particularly desirable. As pointed out elsewhere,[4] it is best to select a vein where a branch is given off. This branch is clamped with a mosquito forceps and will serve as a gauge to show the rate of flow. In my own experience, the flow in transfusion is more likely to be unsatisfactory because of contraction of the exposed radial artery than on account of blockage at the site of anastomosis. Of course, this can be largely avoided by keeping the vessel covered with gauze saturated with warm salt solution. But it is necessary occasionally to inspect the vessels and, as a rule, the vessels are inspected oftener than is necessary and each exposure tends to increase the contraction. As the radial artery firmly contracts, it will almost shut off the flow of blood entirely. If this occurs when sutures are used for transfusion, a small probe can be passed through the venous branch, through the site of anastomosis, and up into the radial artery, thoroughly dilating it. The probe must be perfectly smooth, and should be anointed with vaseline before it is introduced; it must be withdrawn quickly, when it will be followed by a spurt of blood. The venous branch is then clamped as before, and the vessels surrounded with warm moist gauze. Such a procedure is impossible when a fixed cannula is used without the risk of seriously injuring the intima where the metal probe passes through the cannula. Suturing an artery or transfusion of blood can easily be done with this technic in ten to fifteen minutes after the vessels are exposed if the operator has had some experimental experience.

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[4] Journal A. M. A., Aug. 20, 1910.

Suturing blood-vessels seems to be going through the same stage as intestinal suturing underwent fifteen years ago. At that time there were hosts of appliances of all shapes and descriptions for uniting severed intestines, but it was found that with a little practice, a needle and thread was superior to complicated buttons and bobbins, and these appliances have been generally abandoned. It is not improbable that history will repeat itself in the case of arterial suturing.

A NOTE ON THE DIVISION AND CIRCULAR SUTURE OF THE AORTA IN PREGNANT CATS.

BY WALTER M. BOOTHBY, M.D.,

AND

ALBERT EHRENFRIED, M.D.,

OF BOSTON, MASS.

IN a recent article[1] we described in detail our adaptation of the Carrel method of end-to-end anastomosis of blood-vessels, using the abdominal aorta of the cat. During our experimentation we have encountered three cats which were pregnant; as this is a complication hitherto unmentioned in blood-vessel surgery, we think these three protocols worthy of a separate record.

(1) March 17, 1910: Female cat etherized; cœliotomy revealed a uterus containing five fetuses; hysterectomy, excision of one-half inch of the abdominal aorta, reimplantation of the segment by circular suture. After re-establishing the circulation there was no pulsation of the artery distal to the segment; gentle stripping of the implanted artery caused obstruction to disappear and pulsation became visible and palpable.

March 22: Cat alive, but walking unsteadily, eating fairly well.

March 24: Apparently in excellent condition.

March 26: Ninth day; cat found dead; autopsy revealed a small amount of pus in abdominal wound but no peritonitis; aorta found patent, no thrombosis. Lungs showed an extensive bronchopneumonia.

(2) May 24, 1910: Female cat etherized; cœliotomy revealed a uterus containing five fetuses; uterus and intestines retracted under hot towels, aorta clamped, divided, and united with circular suture; uterus and intestines replaced, abdominal wound closed. (Circulation interrupted for fifteen minutes; entire operation occupied thirty-five minutes.)

June 1: Cat is making uneventful recovery from operation, and pregnancy is apparently progressing normally.

We are indebted to Prof. W. T. Porter for the use of the Laboratory of Comparative Physiology in the Harvard Medical School for our experimental work.

[1] Ehrenfried and Boothby: The Technic of Arterial Anastomosis, ANNALS OF SURGERY, 1911, liv, 485.

July 1: Cat is in best of health, active and strong, and is evidently approaching full term.

July 10: During the night the cat delivered herself; one perfectly formed and healthy kitten found with its mother but no trace of the other four fetuses or of after-birth (there were many cats in the same cage, and they were probably eaten).

(3) July 14, 1910: Female cat etherized; cœliotomy revealed a uterus containing five large fetuses; uterus and intestines retracted under hot towels, aorta clamped, divided, and united with circular suture; uterus and intestines replaced, abdominal wound closed.

July 28: Cat has made uneventful recovery from the operation, is perfectly healthy, and is evidently approaching full term.

August 4: Cat to-day observed to have delivered herself during the night, but no trace of fetuses or after-birth found. We presume they were eaten.

Conclusion.—It is possible to completely interrupt the circulation of the abdominal aorta in a pregnant cat for fifteen minutes, divide the aorta, perform a circular suture thereof, and re-establish the circulation without interfering with the course of the pregnancy.

OBSERVATIONS UPON A SERIES OF FORTY-THREE LAMINECTOMIES.

BY CHARLES A. ELSBERG, M.D.,
OF NEW YORK.

FIRST PAPER.

AMONG 43 consecutive operations upon the spine[1] during the past two years, laminectomy for tumor was performed in 13 patients. Of the 13 cases, 9 were extramedullary and 4 were intramedullary growths. Of the extramedullary, the bone and muscles were involved in addition to the meninges in 2 patients, while in 7 the tumor was entirely intradural. Of the latter, 2 were in the dorsal or lumbar cord, 5 involved the conus and the roots of the cauda equina.

There were in all 36 primary laminectomies and 7 secondary operations. In addition to the 13 patients with spinal tumor, there was one with a collection of fluid (arachnoid cyst ?). Posterior root section was done ten times; extirpation of diseased bone pressing on the cord twice; a peculiar disease of the posterior nerve-roots was encountered in one patient; two patients had an acute osteomyelitis of the vertebræ; one, a fracture dislocation; there were eight exploratory operations.

In the operative and post-operative treatment of the patients with spinal tumor, a number of observations were made which are recorded in what follows.

THE EXTRUSION OF INTRAMEDULLARY TUMORS OF THE CORD.

In all of the patients with intramedullary growths of the cord, the tumor was treated by the method of extrusion which has been recently described by myself and Dr. Beer.

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[1] The greater number of these operations were performed by the writer at the New York Neurological Institute, a few were done at Mt. Sinai Hospital, New York. Six patients were operated upon by Dr. E. Beer (section of posterior roots, 4 cases; intramedullary tumor, 1 case; removal of cauda tumor, 1 case).

If, upon exposure of the cord, the growth was found to be an intramedullary one, a small incision was made in one posterior column over the tumor a few millimetres from the median line. The operation was then concluded for the time being, and the muscles, fascia, and skin sutured in the usual manner. About one week later, the wound was reopened and the tumor was found more or less completely extruded from the cord substance, so that it could be removed with little injury to the cord tissue. The tumor usually appears much larger after its extrusion, because of the œdema of the extruded mass.

We have thus far, in the Neurological Institute, treated four cases of intramedullary tumor by the extrusion method, Three of the four cases have already been reported;[2] a synopsis of the history of the fourth patient follows:

Intramedullary glioma of the cord (first, second, third, fourth cervical, and medulla); laminectomy and incision of cord; death from respiratory paralysis two days after operation.

D. C., laborer, thirty-seven years old, admitted to the Neurological Institute on the service of Dr. Fraenkel, on November 27, 1910. The patient gave a thirteen months' history of numbness in the left side of the face, neck, and upper extremity. Soon after the numbness the patient began to have some pain in the back of the neck, and at the same time the left upper extremity became weak. For six months before admission, increasing difficulty in walking; for three weeks, weakness in the right upper extremity. During the first few days' stay in the hospital, it was noted that the patient's pulse was weak and irregular at times.

The patient is a large, well-nourished man; he holds his neck rigid on account of the pain in the back of the neck. His gait is markedly spastic. Over the left side of the face, sensations of touch, pain, and temperature are much diminished. The left cornea is markedly hypæsthetic. There is a marked atrophy of the left trapezius, sternomastoid, serratus, deltoid, supraspinatus, and infraspinatus muscles. All of the reflexes on the left side of the body are exaggerated; ankle-clonus and Babinski on the left side. Wassermann and X-ray examinations negative. No relief of pain by immobilization of spine.

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[2] Elsberg and Beer: Amer. Jour. of the Med. Sciences, November, 1911.

[3] Elsberg and Beer: loc. cit.

January 18: Laminectomy (Dr. Elsberg): Removal of spines and laminæ of second, third, fourth, fifth, and sixth cervical vertebræ. Cervical cord found much enlarged. At the level of the third cervical segment a small cystic looking mass in the left posterior column. Aspiration negative. Small incision in posterior column 1 cm. in length, over the most prominent part of swelling; suture of muscles and skin.

For two days after the operation the patient did very well. On the third day he had several attacks of difficulty in breathing. On the evening of that day he suddenly stopped breathing. In spite of artificial respiration and active stimulation, the heart action became gradually poorer, until it ceased altogether.

The post-mortem examination showed that there was an intramedullary tumor which extended from the third cervical segment up through the cord into the medulla, where it had grown through the posterior surface of the medulla into the posterior fossa. The growth was an infiltrating glioma which had been slightly extruded through the incision in the posterior column, made at the operation. The field of operation was in perfect condition.

REMARKS.—The tumor was of such a size and in such a location that it was remarkable that the patient did not suffer from more marked medullary symptoms before the operation; it is certain that, in a short space of time, he would have died a sudden medullary death if no operation had been performed. No doubt the removal of the spines and laminæ diminished the resistance or support below, and this, together with the gradual downward movement of the tumor in the process of extrusion through the incision in the posterior column of the cord, had caused a pressure upon the medulla in the foramen magnum and thus hastened the medullary death. Had I removed part of the margin of the foramen magnum at the operation (which could have been done with ease), the sudden death might have been delayed, and, if the condition had not been beyond surgical relief, perhaps prevented. The case, therefore, taught us a valuable lesson. In operations for spinal tumors which extend high up on the cervical cord, it is advisable to remove part of the margin of the foramen magnum so as to prevent undue pressure upon the medulla by the extruding tumor (if medullary) or through a secondary œdema of the parts after the operation.

The Value of Extrusion in the Removal of Tumors of the Cauda Equina.—In three of four cases of large tumors surrounding the roots of the cauda equina, I have treated the tumors by extrusion with satisfaction. The amount of injury done to the nerve-roots is much diminished by this method, as the histories of the following cases demonstrate. All of the patients were suffering from extensive endothelioma or endothelial sarcoma.[4]

CASE I.—*Metastatic Sarcoma Surrounding the Roots of the Cauda Equina; Laminectomy and Removal; Death after Two Months.* M. S., forty-two years old, was admitted to the service of Dr. Collins at the Neurological Institute. Two years' history of pain, beginning in the back of the right thigh and in the small of the back. Urinary incontinence and impotence for nine months, stiffness of both lower extremities; numbness and sensations of cold in both feet. Symptoms steadily progressive.

Abdominal reflexes normal, cremasterics cannot be obtained; both lower limbs spastic and ataxic; absent knee- and ankle-jerks. Sensory disturbances over the distribution of the second, third, fourth lumbar and first to fourth sacral roots. Tenderness on percussion over first and second lumbar spines.

January 27, 1910: Laminectomy (Dr. Elsberg) twelfth dorsal, first, second, and third lumbar. Incision of dura revealed large reddish-brown tumor surrounding the lower part of the conus and the roots of the cauda equina. After a prolonged and tedious dissection, during the course of which several nerve-roots had to be divided, the tumor was freed from the nerve-roots and removed. It was only slightly adherent to the dura, but it closely enveloped the nerve-roots, so that each root had to be carefully dissected out from the tumor tissue. Bleeding was only slight and was easily controlled. Suture of dura, muscles, and skin.

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[4] This is a class of cases which have not been adequately described. They present a very characteristic clinical picture. These cases will be described in detail in a paper by Dr. Collins and the writer.

For several days after the operation the lower limbs were paralyzed. Three weeks after the operation he was sitting up in bed, and moving his lower limbs freely. All spasticity had disappeared.

The laminectomy wound healed by primary union. He did not, however, gain in weight, but became more and more cachectic. Soon he began to run irregular fever and to lose weight rapidly. Physical examination failed to show that there was malignant disease in another part of the body. He died eight weeks after the operation. Permission for an autopsy could not be obtained.

CASE II.—*Sarcoma Surrounding the Roots of the Cauda Equina: Laminectomy; Extrusion; Removal; Recovery.* Mrs. P., twenty-five years of age, service of Dr. Collins at the Neurological Institute. Pain in back, radiating down legs for two years, increasing loss of power in lower extremities with drop-foot; increasing difficulty in urination. Complete palsy of tibialis anticus group and of peronei on both sides; knee-jerks and ankle-jerks not to be obtained. Sensory disturbances in lower lumbar and sacral nerve-roots.

December 3, 1910: Laminectomy. Removal of spines and laminæ of eleventh and twelfth dorsal, first, second, third, fourth, fifth lumbar vertebræ and incision of dura, exposing very large tumor surrounding the roots of the cauda equina and extending upward around the conus. Tumor of soft consistency, of reddish-brown color, and not closely adherent to dura. Growth filled the spinal canal surrounding the nerve-roots of the cauda equina. As the tumor gradually bulged out of the canal it was determined to delay the removal. Suture of muscles and skin. Dry dressing.

December 10: Wound reopened. Tumor had been extruded to a great extent, and a great part of it lay outside of the spinal canal. A number of the nerves of the cauda were free of tumor. With little difficulty the greater part of the tumor was peeled off from the roots of the cauda; some small pieces of tumor tissue had to be removed separately from between the roots. The tumor was easily freed from the conus and cord, leaving these structures covered by a thickened, very vascular pia mater. The inner surface of the dura was everywhere smooth and glistening. The tumor extended from the level of the eleventh dorsal vertebræ above to the end of the sacral canal below, it was fairly firm, and not very vascular. Pathological report: sarcoma.

After-course.—The wound healed by primary union. Gradual improvement in all symptoms. Return of full control of bladder. Steady improvement in power in lower extremities. Knee-jerks and ankle-jerks still absent. September 6, walking around with assistance; can sit and stand alone; knee-jerks and ankle-jerks still absent.

CASE III.—*Very Large Tumor Surrounding the Lower Part of the Cord and Cauda Equina; Laminectomy; Extrusion; Removal.* R. E., forty-one years old, service of Dr. Bailey at the Neurological Institute. One year history of pain in back and lower extremities, increasing loss of power in lower extremities; incontinence; impotence; sensory disturbances in legs. Steadily progressive symptoms. Lower limbs markedly paretic, especially the right; double drop-foot; no knee- or ankle-jerks; wasting of muscles in tibialis anticus and peroneal groups. Sensory disturbances over distribution of third and fourth lumbar and all of the sacral posterior nerve-roots.

June 14, 1911: Laminectomy (Dr. Elsberg), removal of spines and laminæ of twelfth dorsal, first, second, third, and fourth lumbar vertebræ, incision of dura. Enormous reddish-brown tumor filling up the spinal canal. Marked extrusion of tumor after incision of dura. Suture of muscles and skin, dry dressing.

July 22: Wound healed by primary union. Delay in operation due to weak condition of patient. Removal of large amount of tumor masses (Dr. Beer) after reopening wound. Most of growth removed in pieces with sharp spoon. Capsule excised as completely as possible.

After-course.—Wound healed by primary union. General condition improved. Slight improvement of sensory disturbances. No improvement in incontinence. Knee-jerks and ankle-jerks still absent. Pathological report of tumor: endothelioma.

CASE IV.—*Endothelial Sarcoma of Cauda Equina; Laminectomy (Eleventh and Twelfth Dorsal, First, Second, Third, and Fourth Lumbar); Extrusion; Removal; Recovery.* George S., thirty years of age, admitted October 1, 1911, service of Dr. Collins at the Neurological Institute. Two years' history of pain in small of back and lower extremities, sensory disturbances in lower limbs, increasing weakness. Weakness in lower limbs, absence of knee- and ankle-jerks; sensory disturbances over lower lumbar and sacral areas; tenderness over lumbar spine; rigidity of lumbar spine.

October 4: Laminectomy (Dr. Elsberg). Removal of spines and laminæ of first, second, third, and fourth lumbar vertebræ in usual manner. Dura very thin and bulged out by large, reddish-brown tumor. Removal of spines and laminæ of eleventh and twelfth dorsal vertebræ to reach upper end of growth. Tumor evidently growing between the roots of the cauda equina, pushing some of the roots backward but most of them forward. Tumor slightly freed from surrounding adhesion. Toilette of wound. Sutures of muscles, fascia, and skin.

October 10: Wound reopened. Tumor 10 cm. long found partly extruded from its bed in the spinal canal. A large number of nerve-roots now lying on the left side of the tumor. Larger part of growth removed in one piece. Numerous small fragments removed from between nerve-roots with sharp spoon. Bleeding moderate. Fragments of tumor tissue left behind without doubt. Toilette of wound; sutures of muscles and skin. Dry dressing.

October 21: Wound healed by primary union. Power in lower extremities improved. Some improvement in sensory disturbances. Unable to empty bladder so that catheterization is necessary. Knee-jerks and ankle-jerks still absent. General condition improved. To receive injections of Coley's fluid.

REMARKS.—The last three cases demonstrated the value of the extrusion method and the two-stage operation in these large tumors which surround the roots of the cauda equina. The difficulties met with in the removal of the tumor in Case I were very great, and by the necessary manipulations, much injury must have been done to the nerve-roots. In the other three patients, the partial extrusion of the large tumors from the spinal canal made their connection with the nerve-roots much less intimate, hence their removal could be accomplished with less injury to the nerve-roots.

THE IMPROVEMENT IN SENSORY AND MOTOR DISTURBANCES AFTER THE RELIEF OF PRESSURE UPON THE SPINAL CORD BY THE REMOVAL OF SPINAL TUMORS, BONE DISEASE, ETC. THE DECOMPRESSIVE EFFECTS OF LAMINECTOMY.

In the eight cases above referred to and in a number of other cases,[5] I have made observations upon the disappearance of paralysis and of sensory disturbances, and the return of reflexes. It is obvious that the return of functions will vary with the variety and size of the tumor, the duration of the disease, the general condition of the patient, etc. Root pains usually disappear very rapidly, the most severe may disappear at once after the operation. After the removal of a tumor lying on the twelfth dorsal segment from a woman who had most violent pain referred to the right twelfth dorsal nerve-root for two years, the pain disappeared at once after the operation. In general, the sensory symptoms are the first to improve and the last to be entirely well; a disturbance of the deep muscle sense may persist for years after the operation.

In many cases, the improvement begins only after a number of days or weeks. In spite of the most delicate operative manipulations, all of the symptoms may at first become aggravated. In several patients in whom a laminectomy was performed in the upper dorsal region, the interesting observation was made, that all reflexes in the lower extremities could not be elicited for twelve to forty-eight hours after the operations. Similar observations have been reported by Bruns, Oppenheim, Flatau, and others.

In patients with advanced spinal symptoms of long duration, however, and especially in those with marked cauda equina symptoms, the beginning of the improvement may be delayed for many weeks or even for months. Absence of knee-jerks and ankle-jerks may persist for years after most of the other sensory and motor symptoms have disappeared. It is obvious that where actual destruction of pyramidal fibres has taken place, exaggeration of knee-jerks, ankle-clonus, etc., may persist for many years or be permanent. After an operation for spinal tumor in which there has been no injury to the cord or nerve-roots, the improvement will occur in the following order: sensory (temperature, pain), then motor, finally sensory (touch), last of all deep muscle sense and sense of position.

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[5] Extramedullary tumor of cord, 2 cases; osteo-arthritis of spine, 2 cases; arachnoid cyst, 1 case, etc.

THE DECOMPRESSIVE ASPECTS OF THE OPERATION OF LAMINECTOMY.

In a number of exploratory operations for spinal disease in which no gross lesion could be discovered, I have observed for days or weeks after the operation, a marked improvement in the sensory and motor symptoms. These have consisted of diminution in exaggerated tendon reflexes, such as exaggerated knee-jerks, ankle-clonus and Babinski, and decided improvement in sensory disturbances. These have been so marked in some of our patients, that it was impossible to explain them as a psychic effect of the operation. There must be some other factor involved, such as circulatory changes or the effect of the spinal decompression by the free removal of a number of spines and laminæ.

THE IMPORTANCE OF CAREFUL HÆMOSTASIS IN SPINAL OPERATIONS.

The amount of discomfort suffered by the patient upon whom a laminectomy with opening of the dura has been done is, in many instances, in direct proportion to the amount of bleeding that has occurred within the spinal meninges. It is of great importance, therefore, to control even the slightest oozing of blood within the dura, and to make every effort to prevent blood from the outside entering the spinal canal. It is often possible to leave the pia-arachnoid intact, so that the fluid under the pia remains clear. In the removal of a spinal tumor, the small vessels should be carefully caught with fine mosquito forceps and ligated with the finest of silk. The posterior spinal artery has many anastomoses, and a ligature can be applied to it in any part of its course, with impunity. Great care in preventing bleeding within the dura may prevent the paræsthesias and root pains which are occasionally observed after these intradural operations. Delicacy of manipulation is, of course, all-important, both to prevent bleeding and injury of the delicate spinal structure. Spinal nerve-roots should never be handled with forceps; if necessary, they should be lifted up with small strabismus hooks.

THE IMPORTANCE OF CAREFUL SUTURE OF THE DURA, MUSCLES, AND SKIN.

Careful closure of the dura by a continuous suture of fine silk will be the surest preventive of cerebrospinal fluid leakage after a spinal operation, and the greatest safeguard against meningeal infection therefrom. The careful suture of the muscles and fascia will also contribute to this end. Good union of the muscles in their proper relations is important for the complete restitution of the functions of the vertebral column. It is well known that the main support of the vertebral column depends upon the intact condition of the bodies of the vertebræ, but the post-operative mobility of the spine will be much better if the muscles and fascia have been well approximated. I have not infrequently had to remove as many as six or seven spines and laminæ, and have seen the patients with functionally perfect spinal columns after their recovery.

PROPHYLAXIS AND TREATMENT OF EPITHELIOMA OF THE LOWER LIP.

BY DOUGLASS W. MONTGOMERY, M.D.,

AND

GEORGE D. CULVER, M.D.,

OF SAN FRANCISCO, CAL.

THE extirpation of the neoplasm is, of course, the main point in the treatment of cancer, but this is not the question considered in this paper. This discourse treats of the origin and the recurrence of cancer of the mucous surface of the lower lip.

Almost all epitheliomas of the red of the lip begin on the surface and erode downward, and almost all if not all of these that so begin superficially are end results of seborrhœa.

This seborrhœa is connected with a line of sebaceous glands that anoint the exposed mucous surface. The line of these glands is often visible in lips that appear to be normal, as a slightly shaded or as a glittering band that stretches like a bow across the front of the lip between one corner of the mouth and the other, and in the median lines about half a centimetre above the cutaneous border. If the lip is seborrhœic, this line may be dry, brown, and facetted, it may be scurffy, it may be crusted, it may be keratotic and run along the apex of the lip as a white rough crest, or it may be heaped up in horny, tightly adherent masses. Although the seborrhœa tends to limit itself to this line, yet it may be much broader and interest the whole of the exposed mucous membrane. As in all these degenerative tendencies, the different symptoms show different degrees in different individuals. A patient may have marked seborrhœa oleosa of the face, with little tendency to form crusted localized patches and epithelioma. The lip on another may be markedly seborrhœic, while the skin is only slightly affected. A patient may have decided crusting of the lip with no epithelioma, while, on the contrary, he may have an epithelioma with a seborrhœa that is only well seen on examination with a lens.

As regards the development of cancer, seborrhœa acts on the lip as it does on the cutaneous surface. The seborrhœa, at some point, becomes more decidedly crusted, and if this crust is scraped off, the tissue beneath will be found eroded. If this eroded portion is examined microscopically, it will be found cancerous.

Although the patient, whose history is about to be given, had epithelioma of the lip and coincident cutaneous cancer, and although we believe that the cancers developed in both situations because of the patient's seborrhœa, we do not maintain for a moment that the two kinds of cancer, that of the lip and that of the skin, are identical. The decidedly greater malignancy, the more rapid growth, the liability to form metastases, and the different histological structure put cancers of the lip in a different category from those of the skin. But all these differences are connected with differences in the nature of the infiltrating epithelial cells, and have nothing to do with the causes inciting these cells to pathologic activity. The same whip may incite both a race horse and an ox to unusual activity, but the animals themselves and the speed elicited are very different.

In reading the above, one might suppose that no attention is to be paid to irritation as a cause of epithelioma, which would be contrary to all clinical experience. In smoking, the irritation of the pipe, the drying effect, and the irritation of the smoke, of the nicotine, and of the products of combustion, all fret the sensitive lip of those having seborrhœa. The patient, the subject of the present paper, had been a heavy smoker, but it was noteworthy that his greatest and earliest cancerous degeneration took place, not on the lip, but on the skin of the face, and not until very recently had anything like cancer appeared on the lip. In regard to the irritations, it is also well known that atmospheric influences, such as heat, cold, strong sunlight, and rude weather act particularly harshly on the skin of those having seborrhœa, and aid in the development of epithelioma of the face and hands. The well-known "sailor skin" of the fisherfolk of the North Sea and German Ocean is an example of this. In the same way we have seen seborrhœic crusts and a consequent epithelioma of the exposed mucous membrane of the lower lip correctly referred to exposure in driving an automobile across the hot sandy valleys of California. But in all probability the influence of these external agents has frequently been exaggerated. Pusey, for instance, in regard to smoking, remarks that he had run across proportionately as many cancers of the lip in non-smokers as in smokers, and this agrees with our experience.[1]

The condition of a seborrhœic lip is best explained by referring to the accompanying photograph (Fig. 1). The black irregular patches on the lip were not really black, but were red crusts of dried blood. In the middle line and to the patient's right these scabs were irregularly scattered over the exposed mucous membrane. To the left of the median line is found a characteristic row of small black dots just above and parallel to the cutaneous margin along the sensitive seborrhœic line above mentioned. This crusting, which is best seen by examining the photograph with a low power lens, ran to the left corner of the mouth. Although the linear arrangement of the disease was not so marked to the right of the median line, yet the roughness and desquamation could be seen to also run out to the right corner of the mouth, so that the whole exposed red surface of the lower lip was diseased from corner to corner. When the crusts were scraped off two shallow erosions were exposed, both of them under the heaviest crusting to the right of the median line. On applying trichloracetic acid to these erosions, the posterior wall of one of them showed a fairly deep, easily bleeding crack, indicating that at this point epitheliomatous infiltration had extended well down into the subjacent connective tissue.

This condition of the lip was only part of a general seborrhœic process affecting the exposed surfaces of the face, neck, ears, and back of the hands. The patient was a miner, forty-seven years of age, whose habits were good with the exception of being a heavy smoker and a hearty cream and butter eater. We mention this because we have reason to suppose that the ingestion of a large quantity of milk fat inclines toward seborrhœa, and smoking is, of course, understood to be definitely related with cancer of the lip. The patient first came to us Sept. 17, 1909, with seborrhœic crusted patches scattered over his face, and a superficial ulceration near the inner corner of the right eye on the side of the nose. There was a large, prominent, heavily crusted, granulating mass on the left cheek, and there were many scars on the face where former lesions had been.

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[1] The Principles and Practice of Dermatology, Wm. Allen Pusey, Second Edition, p. 907.

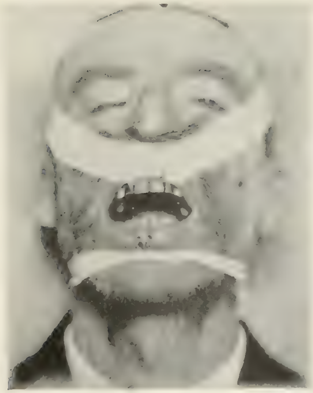
Because of the exuberant granulations of the lesions of the left side of the face, and the scarrings, which we afterward ascertained were the result of former operations, a Wassermann test was made, resulting negatively. He was, however, given iodide of potash and injections of salicylate of mercury, but these had no effect on the condition.

The lesions near the left corner of the eye were curetted and cauterized with a Paquelin cautery, and those of the left cheek and left side of the neck were curetted and cauterized with pure chromic acid crystals, after which the resulting crusts were removed, and the raw surfaces were exposed to X-rays.

Histologically all these lesions were found to be typical epitheliomata.

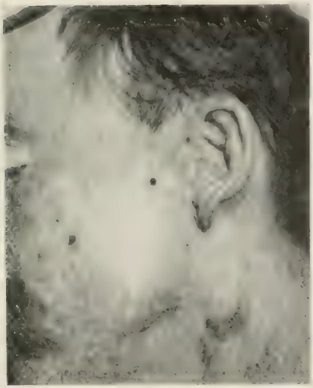
On examining the skin of the face, aside from the crusting and the ulceration, it could be seen to be profoundly seborrhœic. The mouths of the sebaceous glands were patulous, the skin was greasy in some places and red and desquamative in others, and the complexion, where it was not reddened by inflammation, was a straw yellow. This yellow color in many places shone through the skin as small granules, and was evidently due to diseased sebaceous glands. Some of the surface was covered by greasy crusts, and in the photograph (Fig. 2), these can be seen as black spots, representing, in some instances, where the process has gone on to epitheliomatous erosion. In fine the skin of this man's face showed an inveterate tendency to malignant epithelial degeneration, and was an excellent example of epitheliomatosis. The exposed mucous membrane of the lower lip participated in this same tendency.

FIG. 1.



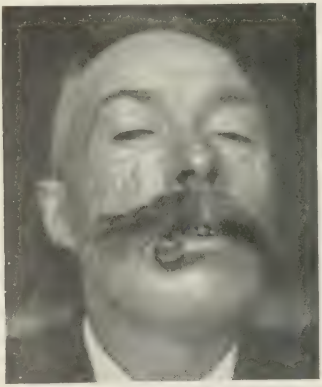
Seborrhœic crusting of the lower lip undergoing cancerous degeneration.

FIG. 2.



Large scar of the left cheek resulting from curetting and cauterization with chromic acid. The scar is smooth and free of seborrhœa. Anterior to the main scar there is an irregularly scarred surface where some of the sebaceous glands were not destroyed. On these intact patches of skin seborrhœa has developed and consequent small epitheliomata, shown in the photograph as black dots.

FIG. 3.



Photograph loaned by Dr. Wm. Pusey, showing an epithelioma together with dark patches on the mucous surface of the lower lip, that are probably seborrhœic. Scars and seborrhœic patches are seen on the face, and what is probably an epithelioma on the right cheek.

It is surprising that a condition having such grave consequences should receive so little attention from dermatologists. The reason it is slighted by surgeons is more evident, as their training is not such as to lead them to pay much attention to a scurffiness of the lower lip. They meet with graver situations that demand instant action, and this action being taken, their work is done. They daily "walk between the living and the dead," and a homily to a patient in peril of his life, laying out to him, in long-winded phrases, how he came to fall into trouble, would be highly inappropriate. When they are consulted, the symptoms of the cancer are so prominent and so grave as to hide or to overtop all others, and any other symptoms on the lips are looked upon as trifling secondary appearances. Furthermore, for some time after the operation is over and the wound is healed, the seborrhœic symptoms of the adjacent mucous membranes are much diminished, on the well-known principle that in the presence of an inflammation of great intensity an inflammation of lesser intensity vanishes. Psoriasis is a striking example of this principle, where the eruption will disappear entirely on the patient's getting pneumonia, to reappear shortly after recovery from the pneumonia. If a man wishes to get an idea of what an advanced stage a frankly ulcerating epithelioma represents, let him have some experience in curetting keratotic seborrhœic patches from the skin, such as those seen in the case above reported, and he will be surprised at the depth of the rotten erosions under some apparently superficial crusts. As above mentioned, there were two well-marked erosions hidden under the crusts of this man's lower lip. When a patient presents himself with a crusted lower lip, it should be carefully examined, not alone with the naked eye, but also with a low power lens. Every man should carry such a lens, and as Grindon says, his affection for such an instrument should not be Platonic, he should use it.

There are several reasons why dermatologists do not mention this condition. In the first place, because of the red color of the mucous membranes, inflammations are not as readily recognizable on them as on the skin. Then again desquamation, that plays such a rôle in the symptomatology of the skin, has to be very severe before it becomes evident on the moist mucous membranes. Furthermore, many dermatologists feel that they are not interested in the lips any more than in the tongue, and they are especially not interested in cancer of the lips as being so evidently the surgeon's work. Therefore, as the condition is on the border both as regards treatment and situation, between two stools the patient falls to the ground.

The condition, however, has not escaped Fordyce, who for so long has been interested in the pathology of the lips. He significantly remarks, in speaking of labial epithelioma, "a number of primary changes in the surface epithelium may precede ulceration or tumor formation. Hyperkeratosis over a limited area, followed by fissure and later by ulceration, is often observed."[2] We can subscribe to all this except the assumption that only a limited area is affected. If these hyperkeratotic lower lips are examined with a low power lens, we are sure most of them will be found diseased from one corner of the mouth to the other. Fordyce, moreover, does not, in this article, connect up the epithelioma of the lip with seborrhœa, which to our mind is the chief point of interest. And we ourselves have been among those who have long ignored this condition of the lip and its relationship with seborrhœa of the skin, and now that our attention is drawn to it, are surprised at its frequency.

The matter of treatment is of the first importance. In the man, the subject of the photographs, whose history is given in the present paper, the seborrhœa was in an advanced state as indicated by the bloody crusting, and the whole lip was curetted and burnt with trichloracetic acid. Trichloracetic acid is an exceedingly powerful keratolytic, possibly the most powerful one we possess, but it must be handled with care. Immediately after applying it, its action should be controlled by the application of wet pledgets of cotton. After the crusts caused by the caustic are cast off, the lip should be treated with X-rays. Care in watching the effect of this remedial agent is also necessary, as a burn of the mucous membrane may be a serious matter. The use of the X-rays, so efficacious in the seborrhœids generally, is here at its best, and is by far the best agent we possess. The ray's action is not deep, however, and this accounts for its bad reputation in epithelioma of this region where cancer is so apt to strike in deeply and quickly. For the seborrhœic eczema itself, however, and for the shallow erosions, there is nothing better. This accounts for the occasional wonderful effect in cancer in such cases as mentioned by Hartzell at the last meeting of the American Dermatological Association. In all probability the infiltration in such instances is far more superficial than clinically it appears to be. We have before called attention to the deceptiveness of the depth of the infiltration of cancer in this region. When it appears to be shallow it is often deep, and when it appears to be deep, its apparent depth is often caused by a coincident inflammation. In this matter there is no absolute trust to be put in anything short of curetting.

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[2] Handbook of the Med. Sciences, vol. xi, p. 683, by John A. Fordyce.

The statistics of reliable surgeons as regards recurrence in cancer are interesting. Serafini, in reporting results in 100 cases, says that recurrence took place in the lip in 24, and in the submaxillary region in 17.[3] J. Clark Stewart says that after the radical operation, although he cannot give exact statistics, he believes that the recurrences will be less than 10 per cent., and that most of these in reasonably early cases will be local.[4]

If we are correct in our view of the early pathology of many of the epitheliomas of the lip, local recurrence is a perfectly natural event, as in these cases the whole lip is affected with a disease that naturally eventuates in epithelioma. For those, therefore, who would rather remove a diseased member than patch it, the radical removal of the entire mucous membrane of the lip, when seborrhœa of the lip exists, would be the only logical course. But as seborrhœa of the lip is usually associated with advanced seborrhœa of the face, and any restitutory flaps got from the patient's own face would also be seborrhœic, then the academically logical procedure would be to flay the face. In the subject of the present paper it would be absolutely necessary to flay the whole face, as the man was affected with a form of seborrhœa showing a peculiar and inveterate tendency to epithelioma; the form that, as before mentioned, is known among dermatologists as epitheliomatosis.

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[3] Considerazioni statistiche sull'epitelioma del labbro, by G. Serafini, Gazetta degli Ospedali, p. 644, Abst. in Jour. A. M. A., Sept. 8, 1906.

[4] The Radical Treatment of Epithelioma of the Lip, Jour. A. M. A., Jan. 15, 1910.

Reference has been made to the amenability of seborrhœa of the lip to treatment. This statement must not be taken as meaning that either the constitutional or cutaneous seborrhœic condition can be cured. This can be no more cured than gout, but many of the seborrhœic manifestations may be controlled for a whole lifetime, and for this many patients are rightfully and devoutly thankful.

ACUTE, SPONTANEOUS PERFORATION OF THE BILIARY SYSTEM INTO THE FREE PERITONEAL CAVITY.*

A REPORT OF SIX CASES FROM THE PRESBYTERIAN HOSPITAL OF NEW YORK AND 108 CASES FROM THE LITERATURE.

BY CLARENCE A. McWILLIAMS, M.D.,
OF NEW YORK,

Assistant Surgeon to the Presbyterian Hospital.

Having personally had two cases of perforation of the gall-bladder into the free peritoneal cavity, my attention was called to the subject and I have gone over all the histories of operations on the biliary system in the Presbyterian Hospital for the past fifteen years. There were 365 such operations, with six cases in which the bile had extravasated through a perforation in the biliary system into the more or less free peritoneal cavity. Such perforations are rare, and not many of these cases occur in the experience of any one man. One is, however, likely to meet with such a case at any time, and one should not be taken off one's guard when confronted with such a condition.

It has seemed to me that something might be learned from going over the recorded cases in the literature. I have been able to collect 108 cases of perforation into the free peritoneal cavity and a table of them appears at the end of this article. The six cases which occurred in the Presbyterian Hospital are as follows. But two of these six died.

Case I.—Chinaman, thirty-eight years of age. History 13622, Sept. 25, 1911. Ambulance. History difficult to get and through an interpreter. Slight attack similar to present illness several years ago. Attacks of digestive disturbances. Onset sudden three days ago, with epigastric pain, nausea, and vomiting. Next day pain localized in right lower quadrant, radiating up and down. No vomiting since yesterday but pain is getting steadily worse. Bowels constipated for three days.

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* Read before the New York Surgical Society, November 22, 1911.

Examination.—Well nourished but prostrated. Leucocytes, 10,000; polymorphonuclears, 85 per cent.; pulse, 114; temperature, 101°. Abdomen full, distended generally though not extreme. Does not move with respiration in lower half and only slightly above. Whole abdomen feels resistant and walls are tense, preventing palpation freely. General muscular rigidity but most marked in right lower quadrant. General tenderness but acute only in right lower quadrant. A little above McBurney's point, where slight pressure causes pain, there is sense of a mass about the size of a large orange, exquisitely tender. Tympany everywhere except a little dulness in each flank.

Clinical Diagnosis.—High gangrenous appendicitis with spreading peritonitis.

Operation at once, Dr. McWilliams, at midnight, Sept. 25, 1911. Gas and ether. High McBurney incision made. On opening peritoneum turbid, greenish-yellow, somewhat purulent, odorless fluid escaped, being free in cavity. Appendix not located. Cæcum involved in mass of recent adhesions. On passing finger upward separated weak adhesion, following which there was a gush of great quantity of bile mixed with flocculi. Right rectus incision over gall-bladder emitting large amount of bile. Omentum adherent to liver. Separated. Great difficulty in finding gall-bladder. It was found deep in posteriorly, very small and contracted, with a perforation admitting tip of finger in cystic duct directly over a large curved calculus. Gall-bladder incised and stone removed. On account of patient's condition, nothing further done. Tube sewn into bladder and two tubes into Morrison's pouch. Closure about tubes.

Patient in poor shape after operation. Infusion 1200 c.c. salt solution with adrenalin 20 minims. Died next morning, eight hours after the operation. No autopsy.

Result of Cultures.—Smears, many pus-cells but no bacteria. Cultures. Predominating cocci in groups and a few gram negative bacilli.

We have in this case both the mechanical and infectious factors present. How much the infection had to do with the perforation it is difficult to say, but the stone had certainly ulcerated the duct which was tightly drawn over the large stone. Had this man been operated upon on the first day of his illness, there might have been a chance for his life, but the form of infection, streptococci, is against any form of peritonitis recovering. It was also unfortunate that a diagnosis of appendicitis was made, for there was evidence of beginning adhesions about the cæcum, and had the gall-bladder been opened at the beginning the peritoneal cavity would not have been so soiled.

Case II.—Man, aged sixty-seven years. Admitted August 20, 1911. Ambulance at 3 P.M. Operator Dr. McWilliams. Complaint, pains all over abdomen, mostly on right side. About two months ago patient had very severe attack of pain on right side just below ribs. Had to stop work for a week. Had constant attacks of nausea and vomiting. Appetite poor. Bowels constantly constipated. Pains gradually wore away. Well until yesterday when suddenly, while bending over a lathe, sudden abdominal pain, so severe that patient could not stand up and knees were drawn up while in bed. Pain was all over abdomen, but most of the tenderness below ribs and lower down on right side. Nausea was extreme and he vomited a great deal of greenish-brown fluid. Took cathartic and bowels moved well.

Examination.—Markedly prostrated, tongue heavily coated. Pulse 88, fair force, slightly irregular. Temperature 99.4°, leucocytes 24,000, polymorphonuclears 92 per cent. Abdomen held rigid, tympanitic over all, with partial obliteration of normal liver dulness. Entire right side of abdomen very rigid, board-like as one finds in stomach perforation, extending to a less degree to left rectus. Excessive tenderness just above right internal ring. Left inguinal hernia, but easily reducible. Right external ring dilated but no impulse. No peristalsis could be heard over abdomen. Some tenderness on rectal examination.

Clinical Diagnosis.—Intestinal obstruction, origin unknown.

Operation at once. Kammerer incision over appendix. Bile poured out of wound in great amount. Removed by passing Blake's irrigating tube into pelvis. Vertical right upper rectus incision. Large amount of bile escaped with particles of fibrin mixed with it, and pus. Large perforation of fundus. No stones in bladder, but finger felt a large rough one impacted in cystic duct. Extracted with Blake's gall-stone forceps. Common duct free, but foramen of Winslow obliterated. Rubber tube sewn into opening in gall-bladder, and the edges of the bladder inverted about the tube by two purse-string sutures of plain catgut. Two rubber tubes, one containing gauze strip, into Morrison's pouch. One tube in appendix wound. Both wounds closed about tubes.

Patient made an uninterrupted recovery. Discharged Sept. 22 to his own physician, with a granulating wound discharging a small quantity of bile. Patient seen, Dec. 1, 1911. Entirely healed and perfectly well. No gastric nor intestinal disturbances.

Case III.—Man, twenty-six years of age. Admitted Jan. 20, 1907. Operator, Dr. McCosh. Private patient. Three years ago attack of jaundice, grew deeper for a few days, and one night attack of pain for an hour in right hypochondrium. Five months ago similar attack but much severer, lasting for five days and with deep jaundice. Four months ago another attack and also three weeks ago, which last attack has not as yet subsided. Skin jaundiced, stools clay-colored. Pain now severe in right hypochondrium.

Examination.—Prostrated, deeply jaundiced. Abdomen held rigid on entire right side, most markedly so in right upper quadrant. Tenderness over whole of right side of abdomen and dulness over gall-bladder region. Temperature 101°, pulse 104, leucocytes 11,660, polymorphonuclears 80 per cent.

Operation at once. Incision over gall-bladder, which was found gangrenous and perforated at fundus, and surrounded by large amount of bile and pus. No stones found anywhere nor in common duct. Cholecystectomy. Tube into stump of gall-bladder. Uninterrupted recovery.

Case IV.—Male, forty-nine years old. On Medical Division for nine days. While there temperature 99.5° to 102.4°. Leucocytes on admission 36,000, on day of operation 40,000. When brought in gave a history that three weeks ago, severe frontal headaches and diarrhœa. Two weeks ago began to have pain in right upper quadrant. Next day went to bed with a temperature of 102°. Chill the day before admission. No vomiting, bowels loose. Two days before admission became acutely delirious and was then brought into the hospital.

Examination.—Large mass made out occupying right side of abdomen, tender, and muscular rigidity. Dulness over it, evidently an abscess.

Operation, Dr. Brown, Sept. 20, 1901. Incision through right upper rectus, giving exit to large amount of bile and pus with a stinking odor. Numerous adhesions. Gall-bladder perforated at fundus, and from it was removed a single, non-facetted stone, the size of a pigeon's egg. Tube drainage of bladder and a second tube into the space below the gall-bladder.

Uninterrupted recovery. Discharged Oct. 19, 1901, with a sinus still discharging pus.

Case V.—Male, forty-nine years of age. Private patient of Dr. Blake. Three months ago vague shooting pains, worse when stomach was empty and relieved by food. No vomiting. Alkali treatment, and got well. Two days before admission, marked abdominal discomfort, vague in character, localized in right upper quadrant of abdomen and small of back. Sense of fatigue and constant desire for food. These symptoms continued until to-day, when he was seized with sharp pain localized in right upper quadrant.

Examination.—Acute tenderness in right side of abdomen, more so over gall-bladder, with great muscular rigidity. No mass could be made out.

Operation at once. Bile free in abdomen and a collection of it in right gutter. Gall-bladder gangrenous in spots and contracted. Interior full of small stones. Gall-bladder removed. General abdominal irrigation with Blake's irrigating tube. Tube into stump and two tubes in bed of gall-bladder.

Uninterrupted recovery. Smears and cultures taken at the time of the operation were sterile.

Case VI.—Male, thirty-one years of age. Operator, Dr. Hawkes, March 17, 1906. An Italian. Heavy drinker up to three years ago. Never an attack similar to present one, which began four days before admission with sudden onset of pain under right lower ribs, with chill, fever, nausea, vomiting, prostration, and constipation. Pain did not radiate and was increased by movements in bed. Vomitus contained food remnants, no bile nor blood. Pain continuous ache, gnawing, not colicky, and none in shoulder. Did not notice that he was jaundiced until attention was called to it in hospital.

Examination.—Temperature 101°, pulse 120, leucocytes 15,000, polymorphonuclears 84 per cent. Exquisite tenderness and rigidity of right rectus, especially its upper part. Respiratory movements much limited on right side. Somewhat distended. On account of rigidity and tenderness, no mass could be made out, but marked flatness below right costal arch. Deeply jaundiced.

Operation: Liver edge found adherent to transverse colon and to anterior abdominal wall by recent adhesions. Gall-bladder not made out. On breaking through adhesions toward duodenum, profuse discharge of thick, creamy, foul-smelling pus mixed with bile. Rubber drainage tube, surrounded by gauze.

After-course.—Jaundice never lessened. Profuse discharge of bile from wound. Had occasional chill and sweat. Lost ground gradually. Temperature remittent, as high as 103° some days. Leucocytes on April 3, 39,000, on the 5th, 62,300, with polymorphonuclears 91.5 per cent. Went into coma and died on the twenty-first day after operation. No autopsy.

Pathology.—The ordinary peritonitis arising from the gall-bladder is usually due to simple diffusion of infection through its walls to the peritoneum. It may result in a collection of pus of greater or less extent about the gall-bladder, but it is almost always well walled in by adhesions and represents a beautiful example of curable localized peritonitis. A very rare condition indeed is a generalized peritonitis due to lack of adhesions and without perforation. Korte has, however, reported three such cases. There are four cases recorded in the literature in which bile was found free in the peritoneal cavity, but in which there was no perforation of the biliary system. One is by Richardson, who says: "In one instance I found the right upper quadrant flooded with bile which had escaped from a gall-bladder that was apparently normal. Drainage was successful." Similar cases are recorded by Clairmont, Schievelbein, and Finsterer.

Much more serious, however, in its consequences and with a mortality rate not much under that of perforations of the alimentary tract must be ranked perforations of the biliary system into the free peritoneal cavity. Normal bile is sterile and is fairly well tolerated in large amounts and for a long time by the peritoneum, in which is set up a chronic irritation which results in the walling-in of the bile. This is well illustrated in traumatic rupture of the gall passages. Witness the interesting case of Garre, in which, two months after the injury, a large quantity of bile was evacuated and the patient was then cured by hepatocholangio-enterostomy; or the case of Hildebrandt, in which operation on the twenty-third day after the injury disclosed a tear in the hepatic duct, recovery following.

In rabbits Noetzel has demonstrated that after an aseptic laparotomy the gall-bladder can be incised and left to drain into the free abdomen, after which the abdominal wound is tightly closed. The animals regularly survived this procedure. In a second set of experiments, he demonstrated that, after opening the peritoneum, the animals recovered after infections were introduced into the cavity, of certain amounts of *Staphylococcus aureus,* in other animals of *Bacillus coli communis*, in others of *typhoid bacilli*, and in others of *streptococci.* He also demonstrated that if even smaller amounts of these organisms were injected into the abdomens of animals and, at the same time, their gall-bladders were incised and left open in the abdomens and the abdominal wounds were then closed, the animals regularly died of septic peritonitis. These experiments show the deleterious effect of bile in contact with peritoneum in exalting the virulence of the organisms. In addition bile diminishes phagocytosis, and by this double mechanism it decreases the means of natural defense of the peritoneum toward infection. Conradi has shown that bile for typhoid bacilli is a good culture medium. He has also shown that the addition of bile to a normal blood-serum promptly does away with the bactericidal properties of such serum, for, if we take 0.3 c.c. normal guinea-pig serum in a dilution of 1 to 80, we will find that this amount will kill 20,000 typhoid bacilli in two hours. If we now add 1.1 c.c. of bile to the same amount of normal guinea-pig serum, a bactericidal effect of the serum cannot be demonstrated, but on the contrary the added typhoid bacilli will grow without any hindrance.

Neufeld and Handel have shown through experiments that this paralytic effect upon the bactericidal quality of the blood evidently rests upon the energetic binding of the complement with the salts of the bile. According to them, sodium taurocholate unites not only with the bactericidal complement, but also with the hæmolytic. These experiments explain why such a rapid destruction of the animals takes places when bile is mixed with weak infections in the abdomens of the animals. There results a great decrease in the bactericidal properties of the serum poured out into the abdomen in response to the irritation, and the animals die of sepsis, or rather of septic peritonitis.

Etiology of Perforation.—We may group these as follows:

1. Rupture from overstretching, with or without stones.

2. Perforation from pressure of a stone upon the wall, causing ulceration.

3. Perforation from gangrene, due to (*a*) thrombosis of vessels, with or without stones; (*b*) cutting off of circulation from pressure of a stone; (*c*) diphtheritic, ulcerative infection of wall, with or without stone.

It is not necessary to do more than state these facts, and discussion of them would be superfluous. The important point from a prognostic and therapeutical aspect of the subject is the amount and virulence of the infection present in the biliary system at the time of the perforation. We may group the cases then into two classes:

1. Those patients with latent stones in their biliary systems who have had no attacks of infection for some time. The contained bile is evidently not perfectly sterile, and if one were to take cultures from it, one would find numerous pathogenic bacteria, but they are actually well tolerated. Such a bladder may become distended, due to obstruction from impaction of a stone in the cystic duct or neck of the bladder, or, if no stones be present, from stricture of the duct with a coincident swelling of the mucous membrane, or from a kink in the cystic duct. Its walls may become paper-thin from overstretching, or very brittle from old chronic inflammation, or weakened from ulceration due to the pressure of a stone. In

such conditions it may be brought to sudden bursting by reason of the compression exercised upon it by the abdominal muscles in the act of coughing, or vomiting, or of bending over. There results a pouring out into the peritoneal cavity of a quantity of bile of a little septic character. It is mechanical in origin and infection plays a small part in the process. There is no great reaction of the peritoneum as a result of its contact with the bile, save in the formation of more or less abundant fibrinous adhesions. An intervention leads to a good prognosis, provided it be not too long delayed, for it prevents the development of secondary infectious complications which are likely to follow if one abandons the patient to his own means of defense; for as we have already seen, the previously existing latent infection may become exalted in its virulence, due to the bactericidal effect of the serum poured out into the peritoneum being diminished by reason of its mixture with bile, while at the same time there is no exit to the infectious fluid which itself is a good culture medium. In addition, one must not lose sight of the fact that infectious agents may emigrate directly from the intestinal canal into the peritoneal cavity through the perforation. Blake reports a case in which there was a primary abscess about the gall-bladder which later burst into the general peritoneal cavity with a fatal issue.

2. The second and grave type is that in which the perforation is directly due to infection and its results. There is present a more or less acute cholecystitis, with obstruction, and the gall-bladder may rupture from increasing tension or through a spot of gangrene of its wall, which may occur because of the cutting off of the circulation through thrombosis of its vessels or by reason of the pressure of a stone. Or an abscess situated in the wall may rupture, thus weakening the wall and leading to a perforation through distention. The process is much less mechanical than infectious, *i.e.,* the calculus plays a secondary rôle, and may be entirely absent. Obstruction may occur through the swelling of the mucous membrane dependent upon the intense inflammation of the

mucous membrane of the cystic or common duct. The perforation may be very sudden and acute, so that the peritoneal cavity is inundated by a very septic fluid with a resulting more or less general peritonitis. The prognosis in such a case may be very grave and may tax the surgeon's judgment to the utmost. A contracted gall-bladder will not contain very much fluid and, if, at the time of rupture, there be no relief in the obstruction, it will take several days for much bile to collect in the abdomen. If, on the other hand, the gall-bladder be thin-walled and much distended, the amount of fluid escaping through the perforation will be very large.

Between these two types there are all grades of commingling. In some cases there is difficulty in saying which element predominates, the mechanical or the infectious. It would seem in some patients with chronic empyema of the gall-bladder as though the calculus and the microbes mutually agree to end in perforation. In the vast majority of cases, perforation of the walls does not progress so rapidly as to take the peritoneum unawares, so that adhesions have time to form. In the rare case, however, with rapid perforation, no adhesions are present, and the rapidity and extent of the consequent peritonitis will depend on the amount of the extravasated bile or pus, and the virulence of its contained organisms. A pinhole perforation of a contracted bladder with a stone blocking the escape of bile will cause the development of a slow, more or less localized peritonitis, while a large sudden perforation in a much distended and infected bladder will cause an overwhelming general peritonitis similar to that which we find in perforation of the stomach or duodenum.

The gall-bladder mucosa presents numerous alveoli formed by fibromuscular bands. They are of various sizes and shapes, and in them we often find large or small calculi which are difficult to enucleate and are, as it were, let into the wall. The alveoli also contain septic fluid and are therefore an excellent culture medium for micro-organisms. The result is an ulcerative process which may lead to perforation and peritonitis. Dieulafoy says that the *Bacillus coli communis* seems to be an essential agent in the ulcerative process. Certain it is that nothing can be elicited from the reported cases as to the bacteriology of these perforations, for in but very few cases have cultures been taken at the time of operation.

Of 90 cases in which the situation of the perforations is mentioned, 82 of them, or 91 per cent., occurred in the gall-bladder, 3, or 3.3 per cent., occurred in the cystic duct, 4, or 4.4 per cent., in the common duct, while but 1, or 1.1 per cent., occurred in the hepatic duct.

In 80 out of 108 cases, or 74 per cent., stones were found at the time of the operations for perforation. From this fact we may infer that calculi, single or multiple, are a great factor in causing perforation. In 14 cases, or 13 per cent., it was found that no stones were present after adequate search. In the 14 remaining cases, or 13 per cent., stones may or may not have been present, as no mention is made of them. Many of these cases were simply drained without search being made for stones.

In but 9 cases is it distinctly stated that gangrene was present. It usually was simply a small area of gangrene, and through this the perforation took place.

Frequency of Occurrence.—That general peritonitis due to a perforation into the free cavity is a rare occurrence the following table of frequency will indicate. No one operator has had many cases, and our ideas of the lesion can only be gained by putting together the single observations of many. Because of the heavy mortality following perforation of the biliary system into the free peritoneal cavity, probably most of the isolated cases have not been reported, so that to gain information as to the relative frequency one must go through the reported series of operations on the biliary system.

	No. of Operations	Cases of Perforation
Adám	112	3
Robson	539	3
Ochsner	48	1
MacLaren	80	4
Kehr	1526	1
Korte	254	7
Jenckel	210	3

	No. of Operations	Cases of Perforation
Ferguson	46	1
Pres Hosp. (McWilliams)	365	6
Totals	3180	29*

Thus we see that the occurrence of perforation into the peritoneal cavity is a very rare accident indeed. There were but 29 cases in 3180 biliary operations. One almost never finds it mentioned in text-books or articles on the differential diagnosis between acute lesions in the upper abdomen. While the lesion is a rare one, it is not so infrequent as one would be led to suppose from the small number of cases published. Are not many of these cases unrecognized? If a calculus completely obstructs the cystic duct, there will be nothing but pus in the gall-bladder with the formation of a purulent peritonitis after perforation, without free bile in the cavity. If there be nothing in the history to call the surgeon's attention to the gall-bladder, there may be nothing found on opening the abdomen in the usual positions to cause one to suspect that the gall-bladder is at fault, and a right diagnosis may not be made until the autopsy table be reached.

Age and Sex of the Patients.—There were 99 patients whose ages are given, and the average age was 50.2 years. The youngest patient was No. 49, whose age was 21 years, while the oldest was No. 44, who was 80 years of age. The disease is one of advanced life as the following statistics show: Between 20 and 30 years: recovered 7, died 2; between 30 and 40 years: recovered 7, died 5; between 40 and 50 years: recovered 14, died 9; between 50 and 60 years: recovered 14, died 21; between 60 and 70 years: recovered 7, died 7; between 70 and 80 years: recovered 4, died 2. Before 50 years there were 44 cases, while there were 55 cases beyond 50 years. Before 50 years there were 63 per cent. of recoveries, while there were but 46 per cent. after 50. How great an influence diseased blood-vessels have upon necrosis and gangrene of the gall-bladder it would be difficult to say.

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* Or 0.9 per cent.

The statistics as to sex are as follows: Females: recovered 35, or 56 per cent.; died 27, or 44 per cent.; total 62, or 60 per cent. Males: recovered 19, or 46 per cent.; died 22, or 54 per cent.; total 41, or 40 per cent. From this we find that 60 per cent. of the cases occurred in women and that they stand the disease better than men, the mortality in women being 44 per cent. as against 54 per cent. in men.

Symptoms and Diagnosis.—Peritonitis due to perforation is a most treacherous complication. It may come on during an attack of biliary colic, and as the symptoms in each case are similar (violent pain and vomiting), it may cause serious mistakes. If an attack of colic leaves a very tender gall-bladder region, the patient should be operated upon at once, but if, for any reason, this be not done, then the patient should be very carefully watched. The degree of spread of infection from the gall-bladder is the important point, as judged by the change in the extent of the abdominal rigidity, tenderness, fever, pulse, leucocytes, and polymorphonuclears. All the cases of perforation were ushered in by pain. If a cholecystitis had been present, then the character of the pain changes. From being a more or less dull, continuous localized ache it becomes generalized over a greater extent of the abdomen, down the right side, and to the navel. There may be in some cases at the time of perforation a sense of temporary relief as the tension of the distended gall-bladder is relieved by the fluid effused from its cavity. This is followed by the signs of peritonitis, more extensive rigidity and tenderness, nausea, vomiting, distention, rapid pulse, temperature, and prostration. In some cases perforation is sudden and without warning, and the symptoms are then like those in perforation of a stomach ulcer. More than one patient with perforated biliary system has been operated upon with the diagnosis of perforated gastric ulcer. In this type we find sudden intense pain, which cannot often be localized but is said to spread over the whole abdomen. The patients become rapidly prostrated, collapsed, vomiting soon follows, and the rigid and tender abdomen becomes distended, flatus ceases to pass, and the pulse becomes rapid and irregular. After a few hours the patient may rally, having the "interval of repose" seen in all forms of perforation within the abdomen.

The tendency of the material which escapes from the gall-bladder is to gravitate downward along the outer side of the ascending colon into the appendical region, which becomes tender and rigid, and at once gives rise to the opinion that one has to deal with a perforated appendix. This is a very frequent mistake in these cases. A careful history and the location of the early symptoms, such as pain and muscular rigidity in the region of the gall-bladder, will enable us often to make a differentiation. A right diagnosis will spare the patient an unnecessary incision and the loss of valuable time with the added danger of opening up protective adhesions. In both my own cases, a wrong diagnosis was made, in one case being due to the inability to get a proper history. A Chinaman (Case I) who spoke no English was operated upon under the diagnosis of perforated appendix, and an appendix incision made. It was not until a large collection of bile was opened into in searching for the appendix that the diagnosis was made of perforated gall-bladder. Thus the gravely infected bile was spread widely, and likely contributed to the fatal outcome, in addition to the added shock of the prolonged operation. The outcome of my second case was more favorable because the infection was not so virulent, due to the earlier operation. The diagnosis was probable intestinal obstruction of unknown origin. On making a Kammerer incision over the appendix, bile at once flowed out and the diagnosis was at once clear. Other diagnoses have been volvulus (Case 81), intestinal obstruction (Cases 18, 24, 91, 97), intussusception (Case 23), intestinal perforation (Case 98), perforated gastric ulcer (Case 47), and appendicitis (Cases 108, 92). One remarkable case is recorded by Kummel, in which a tumor supposed to be ovarian became acutely inflamed, peritonitis followed, with death in two days. The tumor on autopsy was found to be a distended gall-bladder.

The puzzling cases are those in which there is no sudden large amount of effused fluid, but in which there is a steady small leakage. The pain in these cases is not very great in the beginning if the fluid be not very septic. The diagnosis of intestinal obstruction is apt to be made in these cases, due to the pressure of the collection of bile on the intestines and the paralyzing effect of its contained infection.

In 11 cases it is distinctly stated that jaundice was present at the time of the operation. Of these 6 recovered and 5 died. Its presence indicates an advanced case because, if not present at the time of the perforation, it comes on later from absorption of biliary pigment by the peritoneum.

What a large element infection plays in these cases is shown in the relative mortality of operations for traumatic rupture. Thus Rickets reports 28 cases operated upon for traumatic rupture with 22 recoveries, or 78 per cent.

PROGNOSIS AND RESULTS OF OPERATION.

Duration from Perforation to Operation	Recovered	Died	Per cent. of Recoveries	Per cent. of Deaths
Within 12 hours...	6	1	85.7	14.3
1 day	10	5	66.6	33.3
2 days	7	7	50.0	50.0
3 days	8	8	50.0	50.0
4 days	2	8	20.0	80.0
5 days	3	4	42.8	57.2
6 days	2	2	50.0	50.0
7 days	1	1	50.0	50.0
10 days	2	1	66.6	33.3
11 days	0	1		
14 days	2	0		
Totals	43	38	53.0	47.0

The above table very graphically represents how important it is for these patients with perforation to be operated upon as soon as possible after the perforation. Thus in 7 cases operated upon within 12 hours of the perforation 6 recovered, or 86 per cent.; of 15 cases reported operated upon when the perforation had existed for one day, 10 recovered, or 66 per cent.; of 14 cases operated upon after two days, 7 recovered, or

50 per cent.; of 16 cases operated upon after 3 days, 8 recovered, or 50 per cent. Operations after four days give a very poor prognosis, for in 10 cases only 2 recovered, or 20 per cent. The recoveries then increase, due probably to the fact that the patient has developed his opsonins sufficiently to overcome the infection to a greater extent, for of 7 cases operated upon after 5 days, 3 recovered, or 43 per cent. The sixth and seventh days have each 50 per cent. recoveries.

Of the total number of cases that I have obtained from the literature, 108 in number, 56 recovered, or 51.8 per cent., while 52 died, or 48.2 per cent. Rickets reported 160 cases which were not operated upon and of this number but 6 recovered, or only 3.7 per cent. We may say then that without operation a patient with a spontaneous perforation of the biliary system is in a hopeless condition, and even with operation nearly half the patients will die.

Treatment.—Prevention is the key-note in modern medicine. As Korte has said, "To prevent perforation, one should immediately operate when one finds a greatly distended and sensitive gall-bladder with peritoneal irritation." The custom is fairly general of waiting for the disappearance of infectious symptoms in a frank case of cholecystitis. Most of these symptoms will subside and then there is hesitation about operating until another attack occurs. Each attack produces its effect in changing the pathology of the gall-ducts, rendering a subsequent operation more serious for the surgeon and for the patient. In any attack the stretched biliary system may rupture, producing either a local or general peritonitis and rendering an immediate operation imperative.

Perhaps in no acute condition in the abdomen is one compelled to exercise so much judgment at the time of operation as in these perforations into the peritoneal cavity. He who is the keenest observer of the conditions found in the abdomen, who can best estimate the virulence of the infection present, the degree of adhesions, and the pathological conditions present in the gall-bladder system, who can make a good mental estimate of how much or how little the patient can stand who can get in and get out of the abdomen the quickest, inflicting the least possible trauma, will have the greatest success in these trying cases.

The age of the patient must be taken into account in considering what had best be done. Of 100 patients with perforation into the peritoneal cavity, over 56 per cent. occurred in persons over 50 years of age. These elderly persons do not stand infections of their peritoneum well, for 63 per cent. of patients under 50 recovered, while but 46 per cent. of those over 50 years got well. Everything should be done to minimize shock in these elderly persons.

The old question of cholecystostomy *versus* cholecystectomy is naturally one which must be quickly decided upon as the operation proceeds and the conditions are revealed. I have endeavored to get some light on this question from analyzing the reported cases. If we take the cases which were operated upon within 24 hours of the perforation, there does not seem to be a great deal in favor of one procedure over the other, although the cases are too few to draw any very definite conclusions. This is what one would expect because in these early cases one will find few adhesions, and in order to do an ectomy, one would open comparatively few fresh avenues for spread of the infection. Thus, 20 cases were operated upon within 24 hours after perforation: cholecystostomy: recovered 11 or 68 per cent; died 5 or 32 per cent.; cholecystectomy: recovered 3 or 75 per cent.; died 1 or 25 per cent. From this we might argue that the balance is in favor of an ectomy in these early cases.

The operative measures in general which have been used in treating these cases, taken as a whole, are as follows with the results: (1) suture of perforation with drainage of peritoneum: recovered 1 or 20 per cent.; died 4 or 80 per cent.; (2) tamponade of the biliary region: recovered 10 or 47 per cent.; died 11 or 53 per cent.; (3) cholecystostomy: recovered 30 or 61 per cent.; died 19 or 39 per cent.; (4) cholecystectomy: recovered 16 or 48 per cent.; died 17 or 52 per cent.

Suture of the perforation needs merely to be mentioned to be condemned, as it violates all our modern ideas of the treatment of biliary diseases.

Simple incision of the abdomen with drainage of the biliary region gave 47 per cent. of recoveries. Cholecystectomy accomplished very little more, 48 per cent. recovering. The best results were obtained with cholecystostomy with which 61 per cent. recovered. Many of the cases with simple incision were in desperate condition, and the gravity of the general state seemed to contraindicate further measures. It is a question open to discussion how much better results would have been obtained had a better means of drainage been provided, in some of the cases. Thus, the case of Korte (No. 31), which died on the eighteenth day, that of Hawkes (No. 95), which died on the twenty-first day after operation, and of others, brings up the question of whether an intervention more direct to the seat of infection with the drainage of the infected bile to the surface would not give better results. Each operator will have to decide this question for himself in each individual case.

How does it stand with cholecystostomy *versus* cholecystectomy? On first sight one is struck with the success of the former as compared with the latter, 61 per cent. of recoveries with cholecystostomy as against 48 per cent. with cholecystectomy. Cholecystostomy for the average operator is the less dangerous procedure, and should therefore be preferred in these perforative cases. But are there exceptions and, if so, what are they? Cholecystostomy has given brilliant results in some apparently hopeless cases, such as those of Korte, Kummel, Lecene, Mosetig-Moorhof, Thiel, Jaboulay, Whitacre, and others. In other cases the outcome has been such as to suppose that cholecystectomy would have been better. Witness the case of Hirschel (No. 16) who did a cholecystostomy in a patient with acute cholecystitis with gangrene of the neck of the bladder. At first he recovered, but died on the twelfth day of pulmonary gangrene. The same occurrence took place in a patient of Narath (No. 80) on the tenth day. Also the patient of Hartig (No. 12) who had scarcely left the hospital after a cholecystostomy before he had a second perforation of his gall-bladder with a second operation, as a result of which he succumbed. Whitacre's case (No. 86) had two perforations at different times with two different operations with a successful outcome. These secondary ill-results would likely have been avoided by a primary cholecystectomy. The cases with pulmonary gangrene probably had their origin in a persistence of the focus of infection in the bladder gangrene. As a rule, then, we are justified in saying that cholecystostomy should be the operation of choice in cases in which there is little sepsis. In cases, however, where there is a severe infectious cholecystitis with an ulcerative or gangrenous process, *i.e.*, the grave cases, it were better to remove the focus by a cholecystectomy where this is possible. By this means some of the infecting process will be removed. A drain should always, however, be placed in the stump of the cystic duct, and the peritoneum also be drained. Adhesions should not, however, be broken up to accomplish this except to a slight degree. Should bile be free in the abdomen, it would be well to flush the whole cavity quickly with salt solution and to place a drain possibly in the suprapubic area. Nothing by mouth for a few days (the Ochsner treatment), salt solution by rectum according to Murphy continuously, colon irrigations, and the Fowler position should constitute the after-treatment. Gall-stones should be removed at the time of the operation, and in draining, it should be borne in mind that the right kidney pouch forms a distinct peritoneal pocket and that a drainage tube applied through a stab opening in the right loin affords a free exit for extravasated fluids coming from the neighborhood of the gall-bladder.

There is great difference of opinion as to the wisdom of performing a cholecystectomy in these perforative cases. Summers (ANNALS OF SURGERY, July, 1911), says: "All infections of the gall-bladder, empyema, gangrene, should be treated by simple incision and drainage after a protective gauze packing off of the peritoneal cavity. I have known disaster follow cholecystectomy in such cases—the crushing of the cystic duct and its artery, more especially of the poison laden lymphatics; the trauma to the peritoneum passing from the gall-bladder neck to the gastrohepatic omentum can and does in some instances lead to a thrombophlebitis and fatal infections. By free incision into the gall-bladder, gangrene will probably not extend and tension will be relieved." Robson ("Gall-Stones," 1909, p. 161) regarding perforative cases remarks: "Should marked cholecystitis be found, the question of cholecystectomy may be worth considering; but when the patient is in a critical condition, it is a mistake to attempt too much, and, as a rule, cleansing and free drainage will be all that are necessary or advisable at the time, the removal of the cause being left until the patient is better able to bear a more prolonged operation." Moynihan writes regarding the treatment of perforative cases ("Gall-stones and their Surgical Treatment," 1905, p. 279): "In all probability cholecystectomy followed by free drainage will prove to be the safest method of treatment." Cotte and Arnaud say (*Revue de Chirurgie,* March, 1911, p. 358): "In all biliary perforations without a concomitant grave infectious state, one can in general content himself with making a simple drainage of the biliary system. In the grave forms, on the contrary, which result from an active process of ulceration or of gangrene, every time that the situation permits it, one should prefer the ablation of the gall-bladder." Mayo, in Keen's "Surgery," vol. iii, says regarding perforations of the gall-bladder: "The treatment should be immediate abdominal section for the removal of the gall-bladder and free drainage."

CONCLUSIONS.

1. In 3180 operations on the biliary system, acute spontaneous perforation into the free peritoneal cavity occurred 29 times, or 0.9 per cent. It is thus a very rare accident.

2. In 90 cases of perforation, 82 of them, or 91 per cent., occurred in the gall-bladder, 3, or 3.3 per cent., perforated through the cystic duct, 4, or 4.4 per cent., through the com-

mon duct, while but 1, or 1.1 per cent., perforated through the hepatic duct.

3. Calculi are a great factor in causing perforation, for in 80 out of 108 cases, or 74 per cent., stones were found at the time of the operations. In 14 cases, or 13 per cent., it was found that no stones were present after adequate search. In the 14 remaining cases, or 13 per cent., stones may or may not have been present as no mention is made of them.

4. In but 9 cases is it distinctly stated that gangrene was present.

5. Of 99 patients whose ages are given, the average was 50 years. Before 50 years, there were 44 cases with 63 per cent. of recoveries, while beyond 50 years there were 55 cases with 46 per cent. of recoveries. Between 50 and 60 years, there were 35 cases with but 14 recoveries.

6. Sixty-two of the cases occurred in women, or 60 per cent., and they stand the disease better than men, the mortality in women being 44 per cent. as against 54 per cent. in men.

7. Of 108 cases operated upon, 56 recovered, or 51 per cent., while 52 died, or 48 per cent. This is in contrast to the 28 traumatic ruptures, reported by Rickets, operated upon with 22 recoveries, or 78 per cent. The difference is due to infection.

8. Early operation, as in all forms of peritonitis, is the best guarantee of success; thus, of 7 cases operated upon within 12 hours of the perforation 6, or 85 per cent. recovered; of 15 operated upon within one day of the perforation, 10, or 66 per cent. recovered; of 14 within 2 days, 7 recovered, or 50 per cent.; of 16 operated upon within 3 days of the perforation, 8 recovered, or 50 per cent.; while of 10 cases that had gone 4 days before operation only 2 recovered, or 20 per cent.

9. Suture of the perforation is to be unhesitatingly condemned. Four out of 5 cases thus treated died. Simple incision of the abdomen with drainage of the biliary region gave 47 per cent of recoveries. With cholecystectomy 48

per cent. recovered. The best results were obtained with cholecystostomy, with which 61 per cent. recovered.

ABSTRACT OF 108 CASES OF BILIARY PERFORATION FROM LITERATURE.

Case 1 (Von Arx): Female, 48; colics for 2 months, acute for 20 hours; perforation at neck, free bile. Suture of perforation. Cholecystostomy. Recovered. One calculus in gall-bladder.

Case 2 (Baldwin): Female, 50; colics for years, symptoms for one day; perforation in body, free bile. Cholecystostomy. Recovered. Six calculi in gall-bladder.

Case 3 (Baldwin): Male, 55; indefinite colics four days; perforation in body, gangrene. Cholecystectomy. Died. Several calculi in gall-bladder.

Case 4 (Baldwin): Male, 27; symptoms three years, colic two days; perforation in fundus, extensive adhesions. Cholecystectomy. Recovered. Twelve calculi in gall-bladder.

Case 5 (Brunner): Female, 56; symptoms one year, colics not stated; perforation of hepatic duct, abdomen full of bile. Tamponade only of abdomen. Died. Stone in ampulla and two in common duct.

Case 6 (Brunner): Female, 50; stomach symptoms 24 hours; gall-bladder perforated, abdomen full of bile. Cholecystectomy. Died. Calculi in gall-bladder.

Case 7 (Czerny): Female, 61; symptoms five days; perforation of gall-bladder, gangrene; abdomen contained bile. Partial cholecystectomy and suture; abdominal drain. Died. Calculi in gall-bladder.

Case 8 (Delageniere): Perforation of gall-bladder and gangrene. Cholecystectomy. Died. Calculi in gall-bladder.

Case 9 (Finck): Male, 54; symptoms three days; perforation of gall-bladder. Tamponade only. Recovered.

Case 10 (Hallet): Female, 45; colics one day; perforation of gall-bladder. Cholecystostomy. Recovered. Four calculi free.

Case 11 (Hallet): Female, 50; colics fifteen hours; pressure perforation at fundus, free bile. Cholecystostomy. Recovered. Numerous calculi in gall-bladder.

Case 12 (Hartig): Female, 42; symptoms four days; perforation of gall-bladder twice, free bile. Cholecystostomy twice. Died. Calculus in gall-bladder. Two operations.

Case 13 (Hartig): Male, 62; previous colics; perforation of gall-bladder, free bile. Cholecystostomy. Recovered. Perforation over calculus.

Case 14 (Hartig): Female, 53; symptoms six days; perforation in fundus, adhesions. Cholecystectomy. Died. Three calculi in gall-bladder.

Case 15 (Hirschel): Female, 27; symptoms two days; perforation in fundus, localized. Cholecystostomy. Died. Several great calculi.

Case 16 (Hirschel): Male, 57; symptoms four days; perforation near neck by pressure. Cholecystostomy. Died. Single calculus; pulmonary gangrene on eleventh day.

Case 17 (Hirschel): Female, 59; perforation; suture of perforation. Died. Stones not stated; death from pneumonia.

Case 18 (Hochenegg): Female, 45; symptoms 12 hours; perforation at middle; suture of perforation. Cholecystostomy. Recovered. Diagnosis, intestinal obstruction; stones present.

Case 19 (Jaboulay): Male, 66; symptoms two years, colics three days; perforation. Cholecystostomy. Died. One calculus; great.

Case 20 (Jenckel): Female, 45; symptoms three days; perforation at summit. Tamponade only. Died. Stone not stated.

Case 21 (Aurray): Female, 48; symptoms 12 hours; perforation of neck. Suture of perforation. Died. General peritonitis; stones present; no jaundice.

Case 22 (Kehr): Female, 51; symptoms four days; perforation of common duct. Cholecystectomy. Died. Calculi in common and hepatic ducts; perforation of common duct; jaundice.

Case 23 (Konig): Female, 70; symptoms two days; perforation by pressure of gall-bladder. Cholecystectomy. Recovered. Diagnosis, invagination of intestines; calculi numerous.

Case 24 (Korte): Male, 56; colics five days; several perforations in gall-bladder. Cholecystectomy. Recovered. Diagnosis, intestinal obstruction; large calculus; intestinal cavity washed.

Case 25 (Korte): Female, 37; colics three days; several perforations in gall-bladder. Cholecystostomy. Recovered. Calculi present; no jaundice.

Case 26 (Korte): Female, 30; colics three days; perforation of gall-bladder. Cholecystectomy. Recovered. Calculi at entrance of cystic duct.

Case 27 (Korte): Female, 72; perforation of gall-bladder. Cholecystostomy. Recovered. Several calculi; secondary ectomy two months later.

Case 28 (Korte): Female, 63; symptoms four days; perforation of gall-bladder. Cholecystectomy. Died four weeks after operation of embolism; one calculus.

Case 29 (Korte): Female, 51; perforation of cystic duct; drainage in common duct, also cystic duct. Cholecystostomy. Died. Calculi in common and hepatic duct. None in gall-bladder.

Case 30 (Korte): Male, 30; symptoms five days. Tamponade, incision only. Died. Stones not mentioned.

Case 31 (Korte): Female, 56; symptoms five days; perforation of gall-bladder. Tamponade, incision only. Died on eighteenth day after operation.

Case 32 (Kummel-Goldammer): Male, 57; symptoms two days; perforation of fundus, free bile. Cholecystostomy. Died. Calculi present.

Case 33 (Kummel-Goldammer): Female; symptoms three days; free bile. Cholecystostomy. Died. Calculi present; death after a number of days.

Case 34 (Kummel-Kammerer): Female, 33; gangrene with perforation. Cholecystostomy. Recovered. Calculi present.

Case 35 (Kummel-Kammerer): Male, 65; gangrene with perforation. Cholecystostomy. Died. Calculi present.

Case 36 (Kummel-Goldammer): Male, 54; gangrene with perforations. Died.

Case 37 (Kummel-Goldammer): Female, 50; symptoms two days; empyema and perforation. Died. Numerous calculi.

Case 38 (Kuster): Female, 57; symptoms 28 hours; perforation from pressure of calculi. Closure of perforation. Died. Calculi present.

Case 39 (Lecene): Female, 62; symptoms three days; perforation at fundus. Cholecystostomy. Recovered. Single calculus; second operation two months later; cholecystectomy.

Case 40 (Maire): Male, 36; symptoms ten days; perforation of gall-bladder, free bile. Cholecystectomy. Died. Icterus present; cholecystitis; calculus in ampulla removed; hepaticus drainage.

Case 41 (Martens): Female, 58; symptoms three days; perforation of cystic duct, gangrene from pressure. Cholecystectomy. Died from pneumonia; calculi present.

Case 42 (Marwedel): Female, 27; symptoms two days; perforation of gall-bladder. Cholecystostomy. Died. Numerous calculi.

Case 43 (Meriwether): Female, 62; symptoms one day; perforation of gall-bladder by pressure. Cholecystostomy. Recovered. No calculi.

Case 44 (Meriwether): Male, 80; symptoms five days; perforation of gall-bladder. Tamponade only. Died. Numerous calculi.

Case 45 (Von Mosetig-Moorhof): Male, 59; symptoms four days; perforation of gall-bladder at fundus. Cholecystostomy. Recovered. Several calculi.

Case 46 (Neck): Female, 43; symptoms three days; perforation of gall-bladder at summit. Cholecystostomy. Recovered. Numerous calculi.

Case 47 (Newbolt): Female, 48; symptoms two days; perforation of gall-bladder; gangrene; suture of perforation and of abdomen. Died. Stones removed; one impacted in cystic duct. Diagnosis, perforation of gastric ulcer; no jaundice.

Case 48 (Nordmann): Female, 49; tamponade only. Recovered. Stones not stated.

Case 49 (Nordmann): Female, 21; symptoms one day; perforation of gall-bladder, free bile. Cholecystectomy. Recovered. Drainage of common duct; numerous stones; numerous abscesses in gall-bladder wall.

Case 50 (Riedel): Female, 74; symptoms 36 hours; perforation of fundus. Cholecystectomy. Died. Single large stone in neck.

Case 51 (Riedel): Female, 55; symptoms seven days; perforation at fundus. Cholecystectomy. Died. Numerous calculi.

Case 52 (Riedel): Male, 56; symptoms three days; perforation of gall-bladder and of common duct. Cholecystostomy. Died. Pigeon's egg calculus in common duct; hepatic drainage, also Douglas.

Case 53 (Routier): Female, 56; symptoms one day; perforation of common duct, free bile. Cholecystostomy. Recovered. Numerous stones, secondary ectomy.

Case 54 (Schnitzler): Female, 55; symptoms five days; perforation of gall-bladder, gangrene. Cholecystectomy. Recovered. One stone; jaundice.

Case 55 (Schonborn): Female, 50; symptoms three days; abdomen alone drained, free bile. Tamponade of abdomen only. Recovered. No stones found.

Case 56 (Straetter): Female, 63; symptoms five days; perforation of gall-bladder. Cholecystostomy. Recovered. Numerous stones.

Case 57 (Thiel): Female, 59; symptoms three days; perforation of fundus. Cholecystostomy. Recovered. One large stone.

Case 58 (Torrance): Male, 59; symptoms four hours; perforation of gall-bladder, free bile. Cholecystectomy. Recovered. Gastro-enterostomy, appendectomy; stones not stated.

Case 59 (Ullmann): Male, 42; symptoms six days; perforation from pressure of stone in gall-bladder. Cholecystectomy. Died. Numerous calculi, one in cystic duct; no jaundice.

Case 60 (Ullmann): Female, 53; symptoms twelve hours; perforation of gall-bladder, free bile. Tamponade only. Recovered. Numerous stones; no jaundice.

Case 61 (Verral): Female, 44; symptoms four days; perforation of fundus; suture of gall-bladder. Recovered. Numerous calculi.

Case 62 (Villard): Female, 35; symptoms three days; perforation of gall-bladder. Tamponade only. Died. Numerous calculi.

Case 63 (Weigel): Male, 45; symptoms one day; perforation of fundus, free bile. Cholecystostomy. Died. Calculi removed from cystic duct and gall-bladder.

Case 64 (MacLaren, Case III): Male, 50; symptoms ten days; perforation on anterior wall. Cholecystostomy. Recovered. No stones.

Case 65 (Vaughan): Male; symptoms three days; perforation of gall-bladder; drainage of abdomen only. Died. No stones; developed during typhoid and operation for supposed perforation.

Case 66 (Rixford): Male; symptoms two days; perforation at fundus. Cholecystectomy. Recovered. Aseptic perforation; numerous calculi in gall-bladder.

Case 67 (Haggard): Male; perforation of gall-bladder. Drainage of abdomen only. Recovered. Stones free in abdomen.

Case 68 (Moynihan): Male, 46; symptoms eleven days; perforation at fundus, free bile. Cholecystostomy. Died. Seven stones in gall-bladder.

Case 69 (Walker): Male, 27; symptoms three days; perforation at fundus by pressure, free bile. Cholecystectomy. Recovered. Numerous stones; one large one by pressure caused perforation.

Case 70 (MacLaren, Case VIII): Male, 45; symptoms two weeks; perforation at fundus; enormous abscess with bile. Cholecystostomy. Recovered. Stones removed at secondary operation; subdiaphragmatic abscess opened; jaundice present.

Case 71 (MacLaren, Case IX): Female, 31; symptoms ten days; perforation at fundus; large abscess and stones. Tamponade only. Recovered. Jaundice.

Case 72 (MacLaren, Case X): Female, 32; large abscess with stones.

Cholecystostomy. Recovered. Followed on typhoid; secondary cholecystostomy with removal of stones.

Case 73 (Ferguson): Female, 35; perforation at fundus, free bile. Cholecystostomy. Recovered. Several stones; jaundiced.

Case 74 (Noetzel): Male, 52. Cholecystectomy. Died. Stones not stated.

Case 75 (Noetzel): Male, 63. Cholecystectomy. Died. Stones not stated.

Case 76 (Noetzel): Female, 62. Cholecystectomy. Died. Stones not stated.

Case 77 (Noetzel): Female, 65. Cholecystectomy. Recovered. Stones present.

Case 78 (Noetzel): Female, 59. Cholecystectomy. Died. Stones not stated.

Case 79 (Noetzel): Female, 23. Cholecystectomy. Recovered. Single stone present.

Case 80 (Narath): Male, 59; symptoms four days; perforation of gangrenous spot, free bile. Cholecystostomy. Died from pulmonary gangrene. One stone in gall-bladder.

Case 81 (Kranze): Age 67; symptoms two days; perforation at fundus, free bile. Cholecystostomy. Recovered. Diagnosis before operation, volvulus; no stones.

Case 82 (Kranze): Age 70; symptoms six days; perforation at neck, free bile. Cholecystostomy. Recovered. No stones.

Case 83 (Neupert): Female, 42; symptoms 14 hours; perforation of common duct at juncture with cystic duct, free bile. Cholecystectomy. Recovered. Jaundice; acute impaction of stone in common duct. Removed.

Case 84 (Whitacre): Male, 72; symptoms 12 hours; no stones; perforation of gall-bladder, free bile. Cholecystostomy. Recovered. No stones; no jaundice.

Case 85 (Whitacre): Female, 42; symptoms one week; fundus perforated, free bile. Cholecystostomy. Recovered. Many stones in gall-bladder; no jaundice.

Case 86 (Whitacre): Female, 26; first operation 24 hours, second operation 27 hours; perforation in fundus, free bile. Tamponade only in both operations. Recovered. Three operations; two first were cholecystostomies, third was cholecystectomy; two perforations at different times; gallstones present in gall-bladder; jaundice not mentioned.

Case 87 (Whitacre): Male, 58; symptoms two days; perforation in fundus, free bile. Cholecystostomy. Recovered. Stones in gall-bladder; no jaundice.

Case 88 (Whitacre): Female, 50; symptoms one day; free bile. Tamponade only. Died. Stones not stated; no jaundice.

Case 89 (Whitacre): Female, 28; symptoms several days; free bile. Tamponade only. Recovered. Stones not stated; no jaundice.

Case 90 (Kiliani): Male, 40; symptoms four weeks; two perforations in fundus. Cholecystectomy. Died. Two small perforations of ileum found; two stones present.

Case 91 (McWilliams): Male, 67; symptoms one day; perforation in fundus, immense pocket of bile. Cholecystostomy. Recovered. Diagnosis, intestinal obstruction or appendicitis; two incisions; no jaundice; stone removed.

Case 92 (McWilliams): Male, 38; symptoms three days; perforation of cystic duct. Cholecystostomy. Died. Diagnosis, appendicitis; two incisions; stone present.

Case 93 (Dr. Brown): Male, 49; symptoms two weeks; perforation at fundus. Cholecystostomy. Recovered. One stone removed.

Case 94 (Dr. Blake): Male, 49; symptoms two days; perforation at fundus, no adhesions, free pus. Cholecystectomy. Recovered. Many stones; general abdominal irrigation.

Case 95 (Dr. Hawkes): Male, 31; symptoms four days; large abscess, adhesions. Tamponade only. Died twenty-one days after operation. No stones; jaundice present.

Case 96 (Dr. McCosh): Male, 26; adhesions about gall-bladder, gangrene, bile, and pus. Cholecystectomy. Recovered. No stones; jaundice present.

Case 97 (Roersch): Female, 67; symptoms one day; perforation of gall-bladder, free bile. Cholecystostomy. Died. Operation for intestinal obstruction; single stone present.

Case 98 (Erdmann): Female, 46; symptoms 12 hours; perforation of gall-bladder, free bile. Cholecystostomy. Recovered. Diagnosis, intestinal perforation; stones present in gall-bladder; typhoid present.

Case 99 (Jopson): Female, 51; symptoms 72 hours; perforation not located, free bile. Cholecystostomy. Recovered. Stone impacted in cystic duct; jaundice present.

Case 100 (Fritz-Koenig): Female, 70; symptoms two days; perforation at fundus. Cholecystectomy. Recovered. Numerous stones; jaundice.

Case 101 (Williams and Sheidd): Male, 31; perforation of gall-bladder. Tamponade only. Recovered. During typhoid, no stones.

Case 102 (Adám): Female; perforation of gall-bladder. Cholecystostomy. Died. Stones not mentioned.

Case 103 (Adám): Cholecystostomy. Died. Stones not mentioned; jaundice present.

Case 104 (Adám): Cholecystostomy. Died. Stones not present; jaundice present.

Case 105 (Mayo-Robson): Male, 45; several pints of bile and pus. Cholecystostomy. Recovered. Stones not mentioned.

Case 106 (Mayo-Robson): Female, 47; symptoms six days; perforation of fundus. Cholecystectomy. Recovered. Several stones removed; deeply jaundiced.

Case 107 (Gordon): Male, 50; symptoms four days. Tamponade only. Died. Calculi present; jaundice present.

Case 108 (Grant): Male, 53; symptoms 15 hours; quart of bile. Tamponade only. Died. Diagnosis, appendicitis; no stones; no jaundice.

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THE ERROR OF OVERLOOKING URETERAL OR RENAL STONE UNDER THE DIAGNOSIS OF APPENDICITIS.

BY MAURICE H. RICHARDSON, M.D.,

OF BOSTON, MASS.

Surgeon-in-Chief, Massachusetts General Hospital; Moseley Professor of Surgery, Harvard University.

THE diagnosis of appendicitis, after the enormous experience of the past twenty-five years, admits of little if any improvement either in method or in results. Occasionally, nevertheless, I meet with considerable difficulty in recognizing appendicitis with accuracy, or differentiating it from other rare lesions that may closely resemble it. The more I see of this disease, the more I am impressed by my ignorance of it. I cannot help recalling the positive conclusions to which I came after my first five cases. Indeed, now that my cases have risen into the thousands, I find that facts of great importance, especially in connection with the diagnosis, are constantly coming out—facts that in the beginning were never even suspected. Moreover, judging by the post-operative and unbenefited cases that come to me with symptoms and complications which the operator had apparently never suspected or understood, I feel that there may be others beside myself who occasionally overlook the real cause of symptoms and complications. For example, I may mention a left-sided tuberculosis (so it was diagnosticated, operated upon, and abandoned, in Manitoba), which proved to be a chronic appendicitis following an acute perforative localized peritonitis. The patient was cured by removal of a thickened, scarred, and cheesy appendix.

In another case—that of a young man—I found a much-diseased appendix causing symptoms and physical signs which made a genito-urinary specialist fear tuberculosis of the bladder and a medical internist fear cancer of the lower sigmoid; and yet the diagnostic skill of these men was of the highest, and their experience of the broadest. I had the same fears, but felt a strong hope that the lesion was an unusual form of appendicitis. This proved to be the case, and removal of the appendix restored the patient to health. Not a few instances have come to my attention in which similar error has occurred, and I have no doubt that others have been able to make in my cases, abandoned as hopeless and inoperable, an occasional brilliant diagnosis of the real condition of the appendix, and to accomplish complete operative cure.

A very puzzling case was one in which, under the diagnosis of appendicitis (which was correct), operation had been undertaken and abandoned. The operator could not find the appendix. Some months later, as the symptoms continued, I undertook the operation in a confident spirit, only to find myself searching in vain for the appendix through the right half of the abdomen. As there was no cæcum in the right iliac fossa, I carried my incision high enough to explore the region of the gall-bladder, duodenum, and right kidney; but no sign of cæcum or appendix could there be found. My assistant finally observed that the sigmoid flexure started in the right iliac fossa, that, in fact, the viscera were transposed, and that the appendix was in the left iliac fossa, easily accessible through the unusually long incision that I had made.

I will not speak of cases of salpingitis, ovarian tumor with twisted pedicle, extra-uterine pregnancy, cancer of the ileocæcal valve, tuberculosis of the cæcum, psoas abscess, perforation of the stomach or duodenum, strictures of the duodenum or jejunum from unsuspected malignant disease, gallstones, and cholecystitis, as well as many other organic lesions that I have mistaken for appendicitis. My subject—stone impacted in the right ureter and simulating appendicitis so that the operator has been deceived—seems to me, from its frequency and from the ease with which the truth may be demonstrated, worthy of special consideration.

The number of my cases in which appendicitis has been mistaken for a urinary calculus or a urinary calculus mistaken for appendicitis is not large, including the cases operated upon and unoperated upon, in the diagnosis of which a successful differentiation was made before operation. I have collected them all for this paper; but I may not have recognized all there were. In several the surgeon who removed the appendix never knew that the symptoms were due to ureteral calculus, and in some of my own I was at first deceived. How many cases I have operated on by taking out the appendix, with recovery from the operation and synchronous subsidence of ureteral symptoms, I do not know. I dare say that there have been several, judging from the frequency of ureteral stones in my cases since I began systematic search for them. Judging from some of the cases, a stone impacted in the ureter may stay there indefinitely, without any symptoms whatever, after subsidence of those of the original attack. That I have had at least one case like this I know; that there have been others, operated upon and unoperated upon, without knowledge of the true pathology, I am quite prepared to believe.

One object of this paper is to show how easily one may be deceived; another is to show how easily one may escape error.

I look upon the multiplication of appendectomies with complacency, and without any especial objection beyond that of inadequate indications for even this, one of the safest of operations. Except in the highly imaginative and neurasthenic, I do not think unnecessary appendectomy is likely to do any harm in the hands of those well fitted to perform abdominal operations. The *furor operandi,* a few years ago directed against the ovary, has been transferred to the appendix. But in the efforts to find and remedy the cause of abdominal pain, removal of an apparently normal appendix is attended with many beneficent results. I have no doubt whatever that many appendices apparently normal are really dangerous to health and life. How many serious attacks of appendicitis and peritonitis have been prevented by the numerous appendectomies, there is no means of telling. That pain, discomfort, and fever are permanently relieved, I know. I am beginning to see the benefits of normal appendectomies performed in the course of other abdominal operations, for in several cases other causes for peritonitis have been recognized, in the known absence of an appendicular cause. Furthermore, in the case of several patients I have been obliged to operate for acute appendicitis because I had not removed the appendix when it could have been removed easily and safely during some previous abdominal operation for other lesions.

It is the wide-spread belief in the value of appendectomy that makes us perhaps careless in our indications, and especially that indication which rests upon an accurate diagnosis. If we say that in the hands of good surgeons removal of the appendix is likely to do the greatest amount of good at the least exposure of danger and suffering, I admit the truth of this statement, but only when, by the elimination of other causes of pain and discomfort, we are as sure as we can be that we are not mistaking for an appendicular cause some other and more serious disease.

I am about to consider the ureteral stone as a not infrequent "other cause"; but there are, I am sure, many other lesions which are and will be overlooked unless we search diligently for them.

My most recent illustration of these remarks—not twenty-four hours before these words were written—is the case of a girl of three, with menacing symptoms of intestinal obstruction. A year ago a surgeon, operating for abdominal symptoms diagnosticated by the highest authority as appendicitis with abscess, found a slightly affected appendix, without abscess, but with a chain of enlarged lymph-glands from the ileocæcal coil to the receptaculum chyli. I found general peritonitis with no cause other than a broken-down gland in the ileocæcal coil. This case shows that the symptoms of appendicitis may arise from inflamed lymph-nodes, and that the previous removal of a prolific cause of peritonitis simplifies much the diagnosis. Its chief application is toward a careful search for causes other than appendicitis before appendectomy is undertaken.

I wish here to record again my belief and practice in the utmost care in diagnoses upon which depend even trivial operations. Indeed, the safer the operation and the less sure its necessity, the greater the pains to be taken. Abdominal and other operations are performed upon the diagnosis of others; sometimes even upon the patient's own. I have seen too many operations introduced with a remark like this: "The patient is said to have appendicitis. I have not examined her." True, in most instances the operation is necessary; but were all efforts made and precautions taken there would be little occasion to write upon subjects like that of this paper.

A young woman, a stenographer, to whom an operation and its cost were of the utmost importance—much greater than they are in the case of the idle rich—came to me and said: "I am afraid I have appendicitis, and I wish to know. I consulted a surgeon, and said, 'I have pain in my right side and I am afraid I have appendicitis.' He reached over his desk as I sat opposite, touched my side, outside of my clothes, corsets and all, and replied, 'Yes, you have. I will operate in the morning.'" This patient was unwilling to be operated upon after such an examination, and came to me.

It took me a long time to make up my mind in this case, for I had suspicions that the pain might be from a ureteral stone, an ovary, constipation, colitis, movable kidney, or neurasthenia. But, in the end, I came to the same conclusion that the other man did after reaching over his table and touching the girl's dress. I removed an appendix that looked as most slightly offending appendices look. The patient was cured of her pain.

Now, it is in these cases that the rarer causes of abdominal pain are overlooked. Discredit is brought upon surgery; and, worst of all, that discredit is deserved.

The surgeon in his practice is confronted by the greatest possible variety of abdominal pain, especially in women. It seems to me safe to say that without pain of some sort, at some time, the diagnosis of chronic appendicitis is impossible. It is quite conceivable that an infection of the appendix, the result of an acute process, may exist, quiescent, without pain or even discomfort; but there must have been at some time pain of some kind. The tenderness without pain is much less indicative of an affection of the appendix than pain without tenderness. I often find a tender, appendix-like body slipping under the fingers in the left iliac fossa. Such an object in the right iliac fossa I should unhesitatingly call a tender appendix, and, with pain, deduce an appendicitis. In the left iliac fossa it is of course not the appendix. If anything more than the edge of the colon, muscle border, or tendon or nerve, it may mean a ureteral stone, and this suspicion should indicate an X-ray examination, when, if the tenderness were on the other side, the diagnosis of appendicitis would be reasonably clear. But even on the right side these symptoms should indicate an X-ray search, with or without red blood-cells in the urine. Without some attribute of pain, neither the appendix nor a calculus need receive serious consideration.

When there is real pain without constitutional signs, my suspicions are directed toward a possible urinary stone by paroxysms of more than usual violence. Even when appendicular colic is strongly suspected, intermittence suggests other than an appendicular source of pain. A severity requiring opiates or anything more than external applications, without fever, distention, vomiting, or other signs of beginning peritonitis, suggests stone.

In many of the cases we have no opportunity of judging the pain, for we get only the patient's history of it. In a recent case there were violent recurring attacks so suggestive that I made the diagnosis by the history alone. Dr. Dodd found by X-ray " a stone in the ureter near the bladder."

The kind of pain in chronic appendicitis seems to me to differ from that pain so characteristic of renal colic. To weigh the significance of pain in renal colic, we must go back to its beginning, to the spasm of its first engagement in the ureter, for the pain of an old impacted stone may be slight. Not so the pain in the early days of impaction. When the stone is first impacted, the pain is so great that words can hardly describe it. Nothing but morphia or general anæsthesia will control it. A stone caught and held immovably in the ureter, indescribable as is at first the agony that it causes, after a few hours or days, like the gall-stone hopelessly impacted in the common duct, no longer causes pain. There may be even no discomfort whatever. The acute spasm, the unbearable agony, are gone; the muscular spasms no longer continue in their original violence.

But there is one physical sign that always arouses or confirms the suspicion of ureteral stone. Blood in the urine, if only microscopic, is a symptom which should always demand an X-ray examination, though I have it made whenever anything in the history, no matter how trivial, arouses the suspicion of stone.

The diagnosis of ureteral stone simulating appendicitis is exceedingly easy and positive. It is made so by the X-ray, without which it could never be made with certainty. True, by ureteral catheterization scratches upon a waxed ureteral bougie, as Kelly suggests, almost prove the presence of a stone. But with the X-ray much more information can be obtained, and without pain or danger. The diagnosis is easy once a stone is suggested or suspected. The stone is overlooked, not because the diagnosis is difficult, but because the presence of the stone is not even suspected.

We all know but we do not always realize the fact that we overlook pathological conditions easy of diagnosis because we do not happen to think of them. The minute the right but overlooked possibility has been suggested, one pounces upon the diagnosis—every symptom in the history and physical examination will fit into and prove that diagnosis.

This statement is particularly true of ureteral stone; the surgeon is so impressed by the truth that he wonders he did not think of it before. The previous history of renal pain or distress, the intermittent attacks, the gradual shift of situation, the direction of the pain, and last, but most important, blood, even if in microscopic quantities—such symptoms suggest calculus and the X-ray examination. Skilful examinations by experienced X-ray men, controlled by repetitions with a ureteral instrument *in situ,* demonstrate the truth as absolutely as it can be demonstrated in surgical diagnosis.

With such precautions, error in diagnosis, which some years ago seemed to me at times quite unavoidable, is practically beyond serious consideration.

It is not so very important to make out beyond a question the exact diagnosis in acute abdominal emergencies,—at least it is not absolutely essential, because, whatever the pathological lesion may be, the conditions are such that it is without doubt necessary to explore. Not that an accurate diagnosis will not be somewhat of an advantage as guiding the surgeon directly to his lesion; but in emergencies, time is always of such great importance that to spend it in attempting the impossible, when a stroke of the knife will make the diagnosis sure, is the worst of folly.

And yet there have doubtless been many unnecessary and perhaps fatal explorations which a little more careful study of the cases might have prevented: appendectomies and other explorations in typhoid fever; search for acute lesions that did not exist, such, for example, as the search for the cause of intestinal obstruction in the obstipation and pain of lead colic; search for blood when there was no blood; operation for extra-uterine pregnancy when the pregnancy was normal. There has been search throughout the left upper quadrant when the lesion was in the right lower; search for a mechanical cause of intestinal obstruction when there was the *ileus paralyticus* of peritonitis; for duodenal ulcer in cancer of the jejunum; for gall-stones in pancreatitis; for a host of possible lesions remote from a simple gangrenous appendicitis,—in a word, search everywhere but in the right place.

Scattered through my records are cases illustrative of all these things. In explorations shown to be unnecessary—in spite of that fact—the results have been recovery from the exploration, and, in many cases, perhaps through the suggestive effect of the operation *per se,* the patient has been restored to health. When really serious lesions have been found, but only after prolonged search, that loss of time has always added to the danger and increased the mortality. In most emergencies, however desirable the exact diagnosis, there is not much time to study the exact pathology. The surgeon should, however, employ the brief time at his disposal to be as accurate as the case and his experience will permit. Errors, whether of diagnosis or of operation, will occur notwithstanding his care. They will not necessarily result from his want of care.

The whole aspect of the question is changed in chronic conditions. Then there is time in abundance to study the patient from every point of view. If diagnosis is humanly possible, then the diagnosis ought to be made, or, if not made, the reason why it is not made should be shown. I, for one, am tired of seeing abdomens opened for one thing when something else is found; and yet no one knows better than I do the limitations of human skill in diagnosis. As I write these words at the Vincent Hospital, are not my assistants putting to bed a woman in whose case I was sure, both before and after anæsthesia, of the diagnosis of uterine fibroid, and from whom I have just taken a tense, adherent, right-sided ovarian tumor? I claim for myself at least an ordinary skill in the interpretation of abdominal symptoms, and in the digital examination. But, as I have said in other papers, there are certain differentiations in abdominal surgery that cannot be made with certainty, and that between the fibroid and certain other pelvic tumors is one of them. We know it and admit it. Therefore, when an error like this is made, we have discounted the limitations. In all error the sting lies in carelessness, heedlessness, ignorance—in failures even to suspect the truth.

I am quite convinced that too little attention is paid to the diagnosis of chronic appendicitis. So long as there is pain or discomfort anywhere near the appendix, chronic organic disease is diagnosticated and the appendix is removed. I am not opposed to the removal of the appendix when it is diseased; I even favor its removal when apparently normal, if it is easily accessible during other abdominal operations, for I believe that it is a threat to every life, no matter how innocent it looks.

When, however, it is proposed to open the abdomen for the special purpose of seeking and removing the appendix, that is an entirely different matter. Then it is necessary for the surgeon to be as sure as possible that he is on the right track; that it is indeed the appendix that is giving trouble and not some other organ. The exploration is therefore not to be undertaken until all methods of diagnosis are exhausted.

It is here, I believe, that criticism of modern methods is indicated,—I mean the too hasty conclusion that it is always the appendix that is at fault,—criticism of the inadequate history, the superficial examination, the unfulfilled indications for operation.

In my opinion, the less clearly necessary the operation, the more clearly necessary the careful study of the history, physical examination, and contraindications; for the less justifiable the operation, the greater the disaster in case of failure. The greater the haste, the more bitter the repentance. The more neglected the contraindications, the harder to bear the failure.

I am not addressing the occasional operator so much as the expert in abdominal surgery and diagnosis. I have said elsewhere perhaps too much about the wrong done humanity and the science and art of surgery by those who undertake abdominal surgery without adequate preparation for its great difficulties and responsibilities. I do not expect such operators to avoid even the most glaring mistakes, the most disastrous blunders, for they are not qualified either by education or by experience to avoid them.

My first experience of ureteral stone simulating appendicitis occurred some years ago in the practice of a colleague who asked me to see a patient in the next room upon whom he was operating, and in whom, instead of a chronic appendicitis, he had found a stone impacted in the ureter just above the sacro-iliac synchondrosis. I had never met with this lesion in suspected appendicitis, but soon after a similar experience in my own practice emphasized its possibility. I have been on the lookout for this source of error in chronic appendicitis, and have found in my records two dozen cases more or less, in which the diagnosis of stone in the ureter was made, but in which there was strong doubt as to that diagnosis until it was confirmed either by the X-ray or by operation. In the early cases the diagnosis of stone was strongly suspected, but no stones were found, as no operation was deemed necessary under the diagnosis of acute appendicitis. The patients recovered and were lost sight of. In all the later cases the suspicion of stone led, through X-ray investigation by an expert, to a demonstration which in most instances operation confirmed.

As my records approach the year 1911, the cases under consideration increase. Of the twenty-four (and I have no doubt that several cases have escaped my search) five have been operated on after correct diagnosis, in 1911. The question of ureteral stone has come up in several other cases of suspected appendicitis, but that possibility has been eliminated by the X-ray. The diagnosis of ureteral stone seems, therefore, of considerable practical importance.

In my experience the occurrence of ureteral stone, though not unusual at the present time, is very much more common than it used to be; it is common enough, now that my attention has been directed to the possibility of error, to make me think that in the past I must have overlooked not a few times this cause of abdominal pain, and have removed the appendix without even suspecting the real cause. What became of these cases I do not know; it does not seem likely that all these appendectomies failed to relieve recurring pain without that fact in some way coming to me. It is not because I have written upon the subject that physicians are now sending me cases, for I have published nothing upon it. The reason why

I have found so many cases is that I have looked for them. I remember some years ago, before the X-ray was much used, that I was called to cases of supposed appendicitis which I believed to be cases of renal stone, and upon which I did not operate. One or two patients with pain in the right abdomen under the scar of an appendectomy suggested a ureteral stone. These cases I have not included in this paper, for the diagnosis was not proved. From all my available cases in which the diagnosis is unquestioned, I select a few for illustration.

The first case, briefly abstracted, is that of F. W. A., a physician very familiar with appendicitis, who, with the physician attending him, made a diagnosis of acute appendicitis—a diagnosis that was confirmed by Fitz and myself. This patient I saw on Thursday, February 13, 1908. The first symptom was on Monday, and resembled so much a colic that the patient had had fifteen years before that he supposed it came from the same transitory cause. The pain stayed in the same place all Monday night. It was moderately severe. Morphia hypodermically relieved the pain. The bowels were constipated, and all Tuesday was spent in trying to move them. A profuse movement resulted Tuesday night. Pain became localized in the right groin Tuesday. There were two tender places low down in the right iliac fossa. Both testicles were drawn up. Catheterization was necessary. The pain became agonizing, and morphia had no effect upon it; ether alone controlled it. At the attack twenty years before there was no suspicion of a renal cause. There were two or three attacks of colic in the right side of the abdomen. The attacks came on with vomiting, and would leave for a day or two a soreness in the right side. With the vomiting there would be a sharp pain, so intense as to make him faint. Since then there have been no attacks of colic.

There were signs of local peritonitis at the pelvic brim, perceptible by external and by rectal examination. The temperature was not over 100°. The diagnosis was acute appendicitis of moderate severity, with local peritonitis. The patient decided to await developments, and continued in about the same condition. On February 25 the local signs were much less, and the patient very comfortable. The temperature dropped to 99°.

In this case we felt sure of an appendicular origin, but there was a suggestion of renal colic in the history, which, in spite of the local signs in the right iliac fossa, led to an X-ray examination as soon as the patient could leave his bed. A shadow about the size of an almond was found at the level of the sacro-iliac synchondrosis. The advisability of searching for the stone, after proving the diagnosis by ureteral catheterization, was considered, but the patient, wisely, as the event proved, decided to await developments. His view of the case is shown by a letter written three years later (in August, 1911): "I am practically free from disturbances of any kind. An occasional grumble in the abdomen is almost always proven to be intestinal in origin. There is no tenderness over the site of the stone; absolutely no bladder or urinary symptoms of any kind. Micturition is normal in quantity and frequency, and the urine is negative to examination. I weigh 205 pounds; rode in the automobile last year 13,500 miles, over all sorts of roads, with no disturbance or trouble. The last radiograph was taken over a year ago. At that time there was practically no change in the position or size of the calculus. As I look back it is my belief that this calculus has existed in its present location for over twenty years."

This case is used to illustrate the error of diagnosis rather than the treatment of ureteral stone. It is interesting to see that the stone remained thus impacted without causing disability of any kind. One cannot hope, however, often to see so fortunate an ending.

A somewhat similar case is that of Mrs. S., aged forty-five, who was taken suddenly on Saturday with pain in the abdomen, followed by distention. There had been constipation for four days. With the pain and distention there was vomiting. On Sunday the pulse and temperature were up a little. Monday morning the temperature was 102°; at night 103°. At no time was there any rigidity in the right side. A mass could be felt in the right lower quadrant; it could be outlined very accurately by bimanual examination. In this case the diagnosis lay between appendicitis with abscess and pyosalpinx. There had never been any abdominal symptoms before. There was no loss of weight. In the diagnosis appendicitis, salpingitis, inflamed ovarian cyst,

cyst with twisted pedicle, extra-uterine pregnancy, and some complication of a fibroid were considered. Operation showed a localized peritonitis with abscess at the brim of the pelvis and extending to the uterus and bladder on the right side. The patient made a good recovery. After the operation a sinus persisted. Some two or three months later with a probe I felt a very hard, gritty stone. This I removed with difficulty. The stone looked very much like a ureteral stone. I went over the history of this patient again with the greatest care to see if any signs of an impacted stone could be found. I never was able to determine positively whether this stone was of intestinal or of urinary origin. I always felt that it was of renal origin. It was arranged in concentric layers. It seemed to me that this stone had been impacted in the ureter and that all the symptoms and the abscess were the result of it. I never had any positive proof of its origin. The patient would never submit to an X-ray examination. There were no signs in the urine.

This case is of importance in connection with my subject because of the difficulty of telling whether the stone found in the abscess, supposed to be appendicular, was of renal or of intestinal origin. One must not jump to the conclusion when a stone of this kind is found that it has escaped from the ureter. It would have made the course of procedure of extreme doubt had I found the stone at the time of the operation. Unfortunately this patient, an ignorant and timid woman, would not, as I say, consent to an examination which would have proved the diagnosis.

In the case of Miss S., on the other hand, the proof of the renal origin was clear. This patient, twenty-five years of age, had had a severe attack of pain in the right side for which the appendix had been removed. On her way to Boston she was taken with severe pain in the abdomen and went to the Springfield Hospital, where I found her suffering with right-sided pain. She had a temperature of 101° and a pulse of 120. Following this severe attack of pain the X-ray showed a single small stone in the ureter just above the pelvic brim. I explored the ureter at the Springfield Hospital in view of the findings of the X-ray. Instead of finding a stone in the ureter I found a stricture where the stone may have been, but there was no stone. The kidney felt abnormal. I performed a ureteroplastic operation. The patient did well after this operation but there was leakage of urine. At the time of the operation, neither the patient nor the attending physician was prepared for so severe an operation as nephrectomy. Later the patient came to the Corey Hill Hospital, where a careful study with the X-ray showed stones in the right kidney. A study of the urine showed also suppuration on that side. Cystoscopy and ureteroscopy by Dr. Chute showed no urine coming through the right ureter. I therefore removed the right kidney. The patient made a good recovery and remains well. Dr. Whitney reported "diffuse focal suppurative nephritis."

This case illustrates the error in diagnosis better than any other at my disposal. While it is possible that the appendix may have been diseased and may have required removal, in my opinion the ureteral stone was the cause of the original pain and the appendectomy had no effect whatever. In all the cases of renal and ureteral stone that I have had, the possibility of appendicitis has usually been considered especially if the urinary symptoms have been conspicuous. I have taken special pains to inquire in all cases of renal calculus whether at any time the diagnosis of appendicitis has been made. In many it has been made; in a few the appendix has been removed; and in practically all, appendicitis has been considered only to be eliminated.

In a recent case, that of a man of forty-three, the patient had always felt pain in front and back on the right side in the region of the appendix. There had been no urinary symptoms when the patient first consulted me. The attending physician and I had to consider the possibility of appendicitis before considering seriously stone, but the man was sent to Dr. Dodd, who immediately reported a large stone in the right kidney. In this case and in all cases of this kind without the X-ray one might easily be led to operate unnecessarily upon the appendix, overlooking entirely the possibility of a ureteral or a renal calculus.

Another case in which the possibility of an appendicular origin of right-sided pain was considered but in which early resort to the X-ray, suggested by blood and pus in the urine, made the truth clear, was that of a man of thirty-eight who for three years had had right-sided abdominal pain. X-ray examination showed a stone which was passed spontaneously until it got impacted near the end of the urethra, whence it was easily removed. Later, pain in the right iliac fossa suggested either appendicitis or a second calculus. X-ray showed a stone a little beyond the pelvic brim. This also was removed.

A similar case was that of a woman of twenty-seven who in April during catamenia was seized with severe pain in the region of the appendix. In May during catamenia she again had in the region of the ovary and appendix, severe pain which lasted several days. There was no blood in the urine. In July she had severe pain with marked tenderness in the appendix region. There was, however, no rigidity or retraction of the abdomen. The pain lasted for four days and gradually subsided. It was so severe that renal stone was suspected, in spite of pain in the region of the appendix and the marked tenderness over the appendix. The urine was carefully watched and finally a little pus and blood were found in it. The radiograph taken in July showed a calculus in the lower portion of the right ureter. This was removed successfully.

One must not forget that the appendix and stone may be coincident. I have two illustrations of this.

In the first case, that of Mr. S., there was, in 1898, a distinct history of renal stone—unmistakable and confirmed by the passage of a stone from the bladder. In July, 1903, there were such unmistakable signs of chronic appendicitis that I removed the appendix. In August, 1903, the patient was taken with an acute cholecystitis while on a vacation in the woods. Dr. Cousins, of Portland, drained the gall-bladder, but a sinus persisted. I finally removed the gall-bladder with the cystic duct, which contained an impacted stone.

A case somewhat like this one was that of Mr. W., of Leominster. There were symptoms of chronic appendicitis; but something in the history suggested a urinary calculus. X-ray by Dr. Dodd showed a stone in the right ureter not far from the bladder. I first removed this stone, which proved to be a phlebolith. The appendix was enlarged and thickened, and contained two or three firm concretions. Following the ureter back to the kidney, I found several calculi in the renal pelvis. While working at the kidney I could not help noticing that the gall-bladder was full of gall-stones. The patient made a prompt recovery after removal of phlebolith, appendicular concretions, renal stones, and biliary calculi!

In these two cases had there been no urinary calculi found there was abundant evidence of a chronic appendicitis. Nothing called attention to the gall-bladder, however; and the stones at the time of the operation upon the appendix had not caused any symptoms whatever.

The cases which emphasized the error of diagnosis were those in which, after the removal of the appendix, symptoms of pain continued just the same. An appendix scar under which there is pain and tenderness has ever since these early cases suggested at once a ureteral cause. X-ray has shown that cause to be in fact present.[1]

A final case illustrates appendicitis in which the pain simulates that of renal stone.

A girl of nineteen, a stenographer, for a year had recurring attacks of severe pain in the right iliac fossa, radiating in various directions. The pain lasted one or two hours and was followed by tenderness. It was described as unendurable and paroxysmal. With each attack the patient had to give up work for two or three days.

Something in the case suggested the remote possibility of a stone, and I was unwilling to operate without an X-ray examination. The urine was normal in color, acid, and had a specific gravity of 1008. It contained no albumin and no sugar. The X-ray showed no stone, and with that assurance I removed the appendix, which was a long one. From the cæcum to its tip it was a sharp V in shape. Beyond the angle the lumen was distended with fæces; on the proximal side it was empty. This case seems to me to show well the reason why some appendices cause pain suggestive of an impacted stone.

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[1] January 14, 1912: My most recent illustrative case is that of a woman of thirty-five, operated on fifteen years ago and also three years ago for abdominal pain. At these operations, the appendix, both tubes, and parts of both ovaries were removed. She presents herself for treatment on account of the persistence of this right-sided pain, and the X-ray—now used in her case for the first time—shows one large stone and four small ones in the right kidney.

The universal resort to the X-ray in abdominal diagnosis would be, I think, foolish. In the great majority of abdominal lesions the diagnosis is practically without reasonable chance of error, or at least of any error in which the X-ray would be of practical use. In the disease that I have been considering, however, habitual use of the method would obviate such mistakes as those that I have described. In my own practice I lean toward that side in which the X-ray is likely to prove superfluous, but in which the overlooking of a stone may mean disaster, rather than toward the side in which the chances of stone are, from the history and physical examination, so much in favor of stone that there is little possibility of error. In other words, I would insist on the X-ray more in those cases in which stone is suggested than in those in which the stone is sure to be present. That is, I would make the X-ray more and more widely used; more and more a method of precision in doubt—the greater the doubt, the greater the precision. Not that I would abandon for a moment the X-ray to confirm beyond a doubt a positive diagnosis; but I would extend its use to the much more frequent case in which the possibility of stone is suggested, if only remotely. Still further, I would use the X-ray in every abdominal case in which information of value is possible.

On the other hand, we must remember the sources of X-ray error, for even the most expert may make mistakes. I have been led into extensive and bloody search for ureteral stones that did not exist, as in the operation for phleboliths mistaken for ureteral stone; and yet this error may be avoided by the X-ray or a ureteral catheter in connection with this stone.

Such experiences suggest, of course, in the use of the X-ray the highest experts, who know not only the possible errors of conclusion, but how to overcome and neutralize these errors. It is by developing the X-ray methods in ureteral and genito-urinary surgery and in gastro-intestinal diseases that we shall find in this method the greatest assistance in avoiding errors in diagnosis.

NOTE ON THE MESOTHELIOMATA (SO-CALLED HYPERNEPHROMATA) OF THE KIDNEY.*

BY LOUIS BLANCHARD WILSON, M.D.,
OF ROCHESTER, MINNESOTA.
Director of Laboratories, St. Mary's Hospital.

One year ago, assisted by Dr. B. C. Willis, I presented before the Association of American Pathologists and Bacteriologists [1] the results of my studies on 48 cases of so-called "hypernephromata" of the kidney. The literature was reviewed from Grawitz's hypothesis of the adrenal origin of these tumors to January 1, 1910. My observations on the tumors and a re-survey of the relational development of the kidney and suprarenal supported Stoerck's [2] objections to the Grawitzian hypothesis. It seemed to me, however, that there were serious objections to Stoerck's suggestion that these neoplasms arise from convoluted tubules in the contracting kidney. On the contrary, the evidence presented seemed to support and extend Adami's [3] view that these tumors are mesotheliomata of renal origin. Indeed, it appears that all the phenomena observed to date in relation to the so-called "hypernephromata" are best interpreted by the hypothesis that they are the result of proliferation of islets of nephrogenic tissue (mesoblast) which have never become connected with the renal tubules (derived from the Wölffian duct).

Since my report Zehbe [4] has published his observations on a few specimens, which he holds confirm Stoerck's objections to the Grawitzian hypothesis and also Stoerck's suggestion that they do arise in compensatory hypertrophy of renal tubules.

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*Read before the Assn. of Am. Phys., May 10, 1911.

[1] Wilson and Willis: Jr. Med. Res., xxiv, 1910.

[2] Stoerk: Beit. z. Anat. u. Allg. Path., 1908, xlii, pp. 393-437.

[3] Adami: Prin. of Pathology, vol. i, pp. 745-747.

[4] Zehbe: Virchow's Arch. f. Path. Anat., Ed. 201.

Sisson[5] also has reported his studies on five adenomata of the suprarenal and five so-called "hypernephromata" of the kidney. He agrees with Stoerck and myself that the renal tumors have no relationship to the suprarenal, but he finds no evidence of their having arisen from contracted adult renal tissue. He re-states in part my view that they take their origin from isolated nephrogenic tissue, but says that they may possibly also arise from the ureteral bud.[6]

Since the previous report I have studied five more cases of nephrogenic mesotheliomata. All of these confirm the original observations, that each tumor contains areas which are histologically recognizable reproductions of the various stages of the development of the renal cortex from the nephrogenic tissue, while at the same time furnishing pictures which are not found in the suprarenal.

The relationship of the renal tumors of embryonic origin (teratomata, mesotheliomata) as we now understand them may be expressed as follows:

1. *Teratomata or the mixed tumors of Wilms.* These are the most common form of malignant renal tumors of early childhood. Histologically they contain, besides epithelial cells and round- and spindle-sarcoma cells, also hyaline cartilage, striped or unstriped muscle fibres and occasionally ganglion cells. Their origin is probably from very early inclusions within the nephrogenic tissue of portions of the myotome which normally should form skeletal structures.

2. *Nephromatous mesotheliomata* (the so-called malignant "hypernephromata" or "Grawitzian tumors"). These form the larger share of malignant renal tumors of the adult and are frequently wrongly diagnosed sarcomata. Their tissue elements and cell mutations are confined to those passed through normally by the nephrogenic tissue in the development of the renal cortex. They probably arise from masses of nephrogenic tissue which have remained isolated from the surrounding adult renal cortex.

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[5] Sisson: Zeigler's Beit., Bd. 49, 1910.

[6] The obvious objection to this latter supposition is that we do not find in these tumors epithelium of the adult renal pelvic type.

3. *Wölffian "rests" or "tumors."* These are fairly numerous small masses of yellowish-red tissue included within the renal cortex and frequently mistaken for "adrenal rests." Histologically they are distinguishable as of Wölffian origin. They are seldom encapsulated and are always benign. They result from the inclusion within the early formed renal cortex of tubules of the atrophying Wölffian body.

4. *Adrenal "rests" or "tumors."* These are freely described by many observers, but are certainly much rarer than is commonly supposed. They are small, usually whitish masses embedded within the renal cortex and usually encapsulated. Careful microscopic examination of such masses will show that most of them belong in group 3, *i.e.*, are of Wölffian origin.

Such a classification may be of interest to the clinician as explaining certain diagnostic phenomena. Thus teratomata and nephrogenic mesotheliomata are rarely preceded by symptoms of other renal lesions, while primary carcinomata of the kidney very often take their rise from the site of renal calculi. Teratomata, derived from the earliest isolated embryonic tissue, develop in infancy or early childhood. Though of exceedingly rapid growth they are usually so well isolated that early they produce no symptoms except abdominal enlargement, and rarely form metastases.

Nephrogenic mesotheliomata may be considered as developed from embryonic tissue which, while isolated, is yet surrounded by structures developed from similar tissue. This may explain why these tumors usually fail to develop until late adult life. While their growth is often slow, the suddenness with which they sometimes appear after an injury may perhaps be due to the "rest" consisting of a relatively large amount of isolated nephrogenic tissue. That they originate from embryonic rather than adult epithelium may account for the fact that their metastases are by way of the blood stream and not by way of the lymphatics.

Though these suggestions must for the present remain somewhat speculative, they may not be unworthy of consideration.

THE SURGICAL TREATMENT OF DIVERTICULA OF THE URINARY BLADDER.*

WITH THE REPORT OF A CASE AND A NEW DEVICE FOR FACILITATING THE OPERATION.

BY WM. LERCHE, M.D.,

OF ST. PAUL, MINN.

THE presence of a diverticulum of the bladder, when so situated that stagnation of its content is favored, is a constant source of danger to the patient if it becomes inflamed.

Of the various methods of treatment of this condition, the radical removal of the diverticulum by excision has given the best result. The report of fourteen cases thus operated upon can be found in literature, namely, those of Alexander (1884), Czerny (1897), Riedel (1903), Pagenstecher, Young (3 cases), Wulff, Von Eiselsberg (1904), Porter (1907), V. Eberts (1909), Kroiss, Zaaijer, Brongersma (1911). To this number I wish to add the report of a case that has come under my own observation.

Male, aged thirty-eight. Measles, whooping-cough, and chicken-pox in childhood. At the age of twenty-eight the patient experienced two attacks of severe pain in the left abdomen and one attack in the corresponding part of the right side in the course of a year. These attacks were diagnosed as renal colic. He passed no blood in the urine, nor did he pass any calculi. At the age of thirty-one he had an attack of urethritis, which healed in three weeks. Nine months later he had an attack of gonorrhœa, which lasted for fifteen months, but finally healed completely. Urethral sounds were passed for a long time first by the attending physician, later by the patient. Four years previous to consultation the patient noticed thick whitish material in the urine at intervals of a few weeks. Occasionally he had spasm of the sphincter urinæ and could not quite finish the urination. He suffered no pain nor any other inconvenience. Now and then he noticed that on urinating in the morning he could pass urine again shortly afterward. During the last two years the whitish material in the urine has appeared at shorter intervals and has been more abundant, and the urethra has been somewhat sensitive. The condition grew worse since January, 1910, with frequent urination, and he was treated with irrigations of the bladder and instillations.

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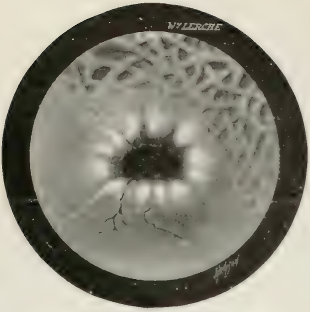
* Read in abstract at the Minnesota State Medical Association, Oct. 6, 1911.

When the patient came under my care a general examination except that of the urinary tract was negative. The prostate was slightly enlarged, and an enlargement was felt in the region of the left seminal vesicle. Repeated examinations showed a residual urine of 200 c.c., which contained a great deal of pus and slime. There was no tenderness nor enlargement in the region of the kidneys or over the bladder. The urethra accepted a 29 F. sound. The bladder was irrigated daily and solution of nitrate of silver instilled. The urine cleared up considerably, but could never be kept entirely free from pus and shreds.

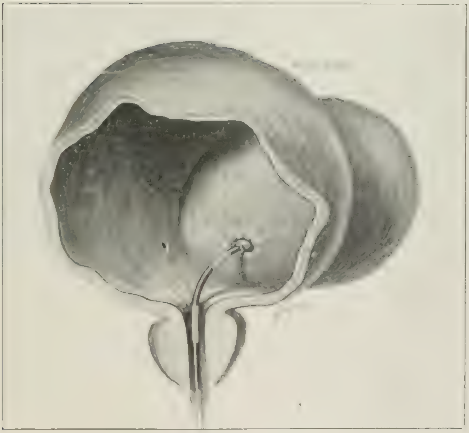
Cystoscopy.—After thorough irrigation of the bladder, 350 c.c. of a boric acid solution was left in the viscus and the cystoscope introduced. The bladder was found to be trabeculated, and there was evidence of cystitis. The left ureter could not be seen, but in that region was discovered a black hole. This opening (Fig. 1) was oval in outline with the lower border somewhat straighter than the upper. It was about 1 cm. in its longest diameter and its margin was thick, as shown in cut, with blood-vessels and radiating folds of mucous membrane curving over it. Whitish, thin shreds could be seen floating in and out of the opening. It was impossible to get the cystoscope into the opening. The left side of the posterior wall of the bladder was bulging forward (Fig. 2), and the right ureteral orifice was on a plane more posteriorly. A diagnosis of diverticulum was made and to verify this a radiograph was taken after introducing 400 c.c. of a 5 per cent. collargol solution into the bladder, a method first used by Volcker in radiographing the kidney pelvis. With the patient flat on his back the plate did not show anything abnormal, but with the patient turned about 35° the diverticulum showed up very well (Fig. 3). The radical removal of the sac was decided upon. In planning the operation the thought occurred to me that if the diverticulum could be distended inde-

FIG. 1.



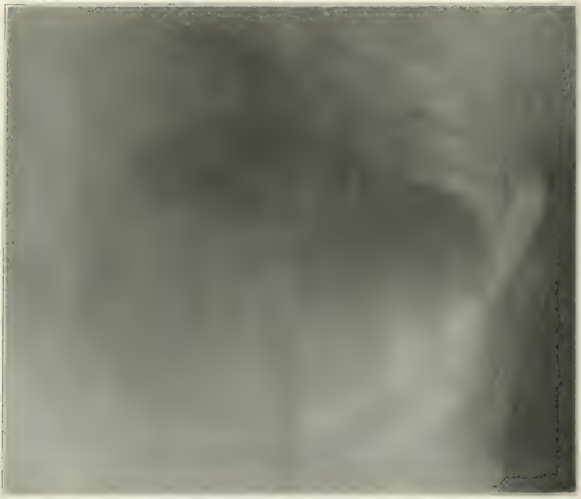
Cystoscopic view of diverticular orifice.

FIG. 2.



Diverticulum distended by inflated rubber bag.

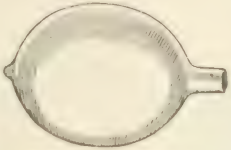
FIG. 3.



Radiograph of diverticulum and bladder taken from left side.

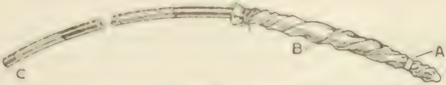
pendently of the bladder, with the latter in a somewhat collapsed condition, it would materially lessen the difficulty of dissection by converting the diverticulum into a tense cyst and raising it higher up in the pelvis. To that end I had little rubber bags made (Fig. 4), which could be fastened securely with a silk thread to the ureteral catheter and wrapped around the latter, a tiny rubber band (*A*, Fig. 5) being slipped over to keep the bag, *B*, in place. When the bag is distended this rubber band is forced off and later passed off by the urethra. The funnel-shaped part of the proximal end of the catheter is cut off (*C*, Fig. 5), in order to enable this end to be introduced backward through the distal end of the catheter carrying tube on the cystoscope. A Brown-Buerger cystoscope is used for the purpose. Fig. 6, *A*, shows the catheter with rubber bag being introduced into the mouth of the diverticulum, *B*. When the rubber bag is in the diverticulum, boric acid solution or normal saline is injected through the catheter into the sac until resistance is noticed. The corresponding amount of fluid is drawn off from the bladder. The bulging rubber bag can also be observed in the mouth of the diverticulum through the cystoscope. The number of cubic centimetres used will give the exact size of the diverticulum. When the latter is fully distended the proximal opening of the catheter is plugged by a thick, straight needle. The diverticulum in my case measured exactly 200 c.c.

FIG. 4.



Rubber bag (actual size).

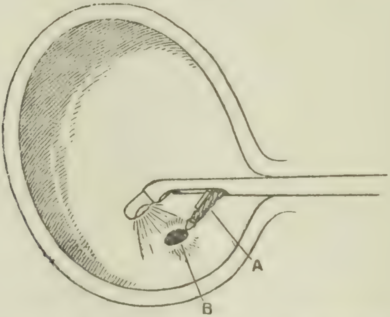
FIG. 5.



Rubber bag (*B*) tied to catheter and held by rubber band (*A*).

Operation.—With 350 c.c. of a boric acid solution in the bladder, the rubber bag on the ureteral catheter was introduced into the diverticulum through the cystoscope; 200 c.c. of boric acid solution was injected into the rubber bag in the diverticulum, while the corresponding amount was let out of the bladder, leaving about 150 c.c. or less of the solution in the latter. The distended diverticulum could be felt per rectum like a tense cyst. Ether anæsthesia. Through an incision 10 cm. long through the left rectus muscle, with the patient in the Trendelenburg position, the pelvis was entered extraperitoneally. The peritoneum was stripped off from the left side of the bladder and pelvic wall, and the tense wall of the diverticulum reached. The benefit of the rubber bag scheme was immediately appreciated. An attempt was made to dissect the diverticulum off from the peritoneum, but this could only be done half way around on account of the firm adhesions. The outer layer of the wall of the diverticulum was therefore cut through, and it could then be shelled out. The left ureter was found on the mesial side of the diverticulum being pushed to the right, and the left seminal vesicle was behind and underneath it. The diverticulum had somewhat undermined the trigonum, and it extended backward into the hollow of the sacrum and was adherent to the rectum. The rubber bag was now emptied, and on cutting through the neck of the diverticulum from the left side the bag with the catheter could be pulled out through the abdominal wound. The orifice of the left ureter was seen on the mesial wall of the diverticulum about 1 cm. from the

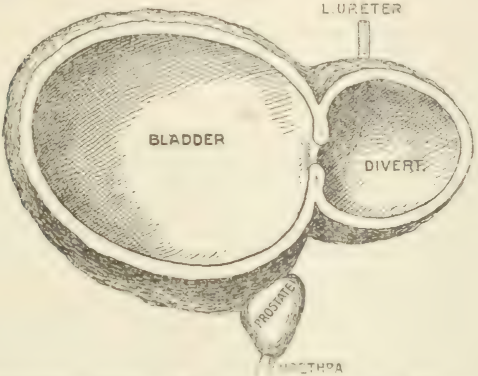
Fig. 6.



Catheter with rubber bag in cystoscope ready to be introduced into diverticulum.

opening into the bladder (Fig. 7). The diverticulum was removed and the opening in the bladder sewed up with two layers of continuous formalized catgut sutures, the left ureter being implanted into the bladder through the same opening. Split tube drainage with gauze wick was left in the large extraperitoneal cavity, and the abdomen closed except for drainage opening. The neck of the bladder was dilated to 43 F. with a Kollman dilator and a retention catheter was left in the bladder. The extraperitoneal drain was removed on the fourth day. Frequent spasms interfered with the bladder drainage, and a posterior urethrotomy was therefore made and a large tube put into the bladder. The neck of the bladder was found hard and fibrous and did not admit the tip of the forefinger. The patient made an uneventful recovery and left the hospital on the thirty-fourth day. Three weeks later I removed part of the fibrous neck with Young's [1] ingenious median prostatic bar excisor *per urethram* under local anæsthesia.

FIG. 7.



Lateral view of bladder and diverticulum, showing position of left ureter.

The patient has been well since and has gained in weight. The urine was cloudy for some time after the operation.

The inner surface of the diverticulum was smooth and of a dull greyish-red color; there were no trabecula in the sac. The epithelium was absent in places; muscular fibres were present in the wall.

RÉSUMÉ OF OPERATIVE METHODS IN THE FOURTEEN CASES RADICALLY OPERATED UPON.

Vaginal Route:—Alexander's[2] case: A diverticulum of the bladder protruded from the vulva. A stone was removed from the sac and the latter was ligatured at its neck and cut off. The woman recovered with a small fistulous tract.

Sacral Route:—Pagenstecher's[3] case: Male, aged 33. Suprapubic cystotomy disclosed a diverticulum with its opening in the region of the left ureteral orifice. Drainage of diverticulum. Second operation: temporary resection of sacrum, removal of diverticulum, and transplantation of left ureter, which ended in the diverticulum, into the bladder. Recovery. Sacral scar painful. Sacral urinary fistula present when last seen.

Suprapubic Intraperitoneal Route:—Von Eiselsberg's case, reported by Wagner:[4] Male, aged 48. No prostatic enlargement. Cystoscopy: trabecular bladder, diverticulum near summit on right side. Intraperitoneal excision of diverticulum, closure of bladder wound with catgut. Retention catheter. Recovery.

Riedel's[5] case: Male, aged 61. Moderate prostatic hypertrophy. Partial prostatectomy. Continuation of symptoms. Later suprapubic cystotomy revealed a large diverticulum with large opening above right ureteral orifice. Bladder temporarily closed, then incision through right rectus muscle. Serosa over diverticulum incised and the latter dissected free, invaginated into the bladder, and removed. Diverticular orifice closed intra- and extravesically with catgut. Abdominal drainage of cavity, perineal drainage of bladder. Death.

Zaaijer's[6] case: Male, aged 58. Moderate prostatic enlargement. Suprapubic cystotomy. An opening found to a diverticulum behind the interureteric bar. Trabecular bladder. Septum divided and margins sutured. Functional result poor. Second operation: Laparotomy. Suprapubic cystotomy. Peritoneum over diverticulum incised, the sac dissected free, pulled into the bladder, and cut off. Diverticular orifice closed intravesically. Perineal drain behind bladder. Abdominal incision closed. Cystotomy wound left open—drainage. Recovery.

Porter's[10] case: Male, aged 34. Prostate moderately enlarged. Cystoscopy: Three diverticula. First operation, suprapubic drainage. Second operation, suprapubic cystotomy reopened and the orifices of the diverticula stretched. Drainage. Third operation, incision parallel with Poupart's ligament. Peritoneal cavity opened. Cystotomy wound reopened. The largest diverticulum was excised. Suprapubic drainage and retention catheter.

Later: suprapubic fistula keeps open if urethral catheter is not in place.

Suprapubic Extraperitoneal Route:—Czerny's[7] case: Male, aged 30. Traumatic stricture of membranous urethra. Suprapubic cystotomy revealed a diverticulum with opening in the region of left ureteral orifice. Suprapubic drainage of diverticulum. Second operation: Diverticulum removed extraperitoneally through a transverse incision of the left rectus. The left ureter terminating in the diverticulum was transplanted into the bladder. Opening closed with two rows of catgut. Suprapubic drainage, also urethral retention catheter, drainage of the extraperitoneal cavity through abdomen. Four months later left nephrectomy. Recovery.

Young's[8] case: Male, aged 30. Urethral stricture. Cystoscopy. Two diverticula, one very large. Suprapubic extraperitoneal excision of both; right ureter in diverticulum was sewed into the bladder with a flap cut of mucosa. Drainage of bladder through a perineal urethrotomy. Drain of extraperitoneal cavity by tube behind prostate through perineum. Suprapubic fistula healed later after a Bottini operation on middle prostatic lobe. Cure.

Young's case: Male, aged 34. Cystoscopy. Small diverticulum in urachus caused by a fall. Suprapubic extraperitoneal excision of sac. Cure.

Young's case: Male, aged 63. Cystoscopy. Large diverticulum due to prostatic hypertrophy. Suprapubic extraperitoneal excision of diverticulum, perineal prostatectomy. Cure.

Wulff's[9] case: Male, aged 34. Cystoscopy, diverticulum on right side. Incision parallel with Poupart's ligament; diverticulum opened extraperitoneally, cavity tamponed. Later diverticulum excised and communication with bladder closed. Retention catheter in bladder. Bladder sutures failed. Later edges of opening into bladder had to be freshened and sutured again. Patient when discharged had 150-200 c.c. residual urine.

V. Eberts'[11] case: Male, aged 32. Right-sided nephrectomy for pyelonephrosis. Urine continued cloudy—hence suprapubic cystotomy, which revealed a diverticular opening 2.5 cm. to the outer side of the right ureteral orifice; drainage of diverticulum. In a third operation the diverticulum was removed extraperitoneally through a suprapubic incision, aided by a finger in the diverticulum through the reopened bladder wound; opening closed with a purse-string suture. Suprapubic drainage of bladder. Drainage of extraperitoneal cavity through perineum. Cure.

Kroiss'[12] case: Male, aged 28. Cystoscopy; X-ray. Orifice of diverticulum 2.5 cm. behind and to the left of the left ureteral orifice. Large suprapubic cross incision to left of median line. Diverticulum removed extraperitoneally with the aid of the finger in the sac through a suprapubic cystotomy opening. The opening of communication closed with interrupted sutures. Suprapubic drainage of bladder. Extraperitoneal cavity tamponed and wound left entirely open. Recovery.

Brongersma's[13] case: Male, aged 61. Bladder trouble since age of 15. Prostatic hypertrophy. Cystoscopy. Diverticular opening to the left of left ureteral orifice. X-ray. Suprapubic extraperitoneal excision of diverticulum. Closure of diverticular orifice with catgut. Recovery.

The case of Péan,[14] which by a number of writers has been grouped with the diverticula, seems to be a case of supernumerary bladder—an embryonal malformation—and is therefore perhaps better grouped with the cases of Wolfler and Colzi (cit. by Schwartz[15]), and does not belong to the diverticula described in this paper. For the reason, however, that several writers have included the case, it is appended here.

Péan's case: Female, aged 15. Incontinence of urine since birth. A small sac was felt through the anterior vaginal wall, which communicated with the exterior through an 8 cm. long canal terminating 3 mm. below the normal urinary meatus. Péan dissected out the mucous membrane of the sac and canal and closed the defect. The sac communicated with the bladder. Cure.

Wolfler's case: Female, aged 12. Incontinence of urine since birth. Below the normal meatus was found a minute opening from whence came urine. No communication could be demonstrated between the bladder and sac. Both the urethral canals were forcibly dilated, and an anastomosis made between the bladder and sac with a specially constructed pressure forceps. The patient was "almost" relieved of her incontinence.

Colzi's case: In a young girl with incontinence of urine. An extra opening was found below and to the left of the normal meatus, from which dribbled urine. At operation it was found that this opening communicated with a sac into which ended the left ureter. The sac was extirpated and the ureter implanted into the bladder. Recovery.

Of other methods of treatment can be mentioned:

(*a*) Simple incision through the vaginal wall with drainage of the diverticulum.

Chaput's[16] case: Female, aged 50. Tumor to right of cervix uteri thought to be fibroma. Incision through vagina revealed a vesical diverticulum containing large quantity of urine and mucopus. Communication with bladder could not be found. Drainage of bladder and diverticulum. Recovery.

(*b*) Establishment of a fistula by sewing wall of diverticulum to the skin of the abdominal wall.

Ljunggren's[17] case: Male, aged 12 years. Ljunggren first made a fistula between diverticulum and abdominal wall. One year later he made an anastomosis between the bladder and the diverticulum. Cure.

(*c*) Perineal drainage of the bladder.

Burckhardt's case: (Cit. by Pagenstecher. The case was reported by Burckhardt, but not treated by him.) Male, aged 43. Cystoscopy. Diverticulum above right ureteral orifice. Perineal urethrotomy through which the bladder was drained. Death.

(*d*) Forcible stretching of the orifice of the diverticulum.

Guibal's[18] case: Male, aged 68. Gonorrhœal stricture and prostatic hypertrophy. Suprapubic cystotomy. The bladder of the size of a hen's egg; the diverticulum held a quart and a half. The orifice of the diverticulum was forcibly dilated with the finger. Suprapubic drainage. Death.

Mumford's case: Suprapubic cystotomy with drainage of the bladder was first done, without relief. Later suprapubic cystotomy with stretching of the diverticular orifices with negative result. Finally the case was radically operated upon. (Reported by Porter, *loc. cit.*)

Langer's[19] case: Male, aged 38. No stricture, stone, nor prostatic hypertrophy. Suprapubic cystotomy. Dilatation of the orifice of the diverticulum. Death.

(*e*) Curettement of diverticulum and closure of its margins with sutures.

Pousson's[20] case: Male, aged 78. Prostatic hypertrophy. Suprapubic cystotomy, three calculi. Middle prostatic lobe removed. A small diverticulum containing a calculus was curetted and edges of orifice freshened and united by sutures. Bladder drained. Cure.

(*f*) Invagination of diverticulum into bladder, freshening of margins of orifice, and closure intraperitoneally.

V. Eiselsberg's case. (Reported by Wagner, *loc. cit.*) Male, aged 58. Three diverticula demonstrated by cystoscopy. Laparotomy. One small diverticulum near the summit was invaginated into the bladder and the margins closed by sutures. The larger diverticulum could not be found. Death a few months later.

(*g*) New anastomosis between bladder and diverticulum.

Ljunggren's case, *loc. cit.* Cure.

(*h*) Enlargement of diverticular orifice by incision of the septum or crushing with forceps.

Young's case, *loc. cit.* Male, aged 66. Cystoscopy revealed two diverticula. Suprapubic cystotomy; incision of septa; suture of cut edges. Voluntary urination restored; patient well, but has 300 c.c. residual urine.

Zaaijer's case, *loc. cit.* Male, aged 58. Suprapubic cystotomy; division of septum; suture of cut edges; functional result poor. Later radical excision of diverticulum.

Serralach's[21] case: Suprapubic cystotomy; several incisions in the margin of the diverticular orifice. Recovery. Functional result negative.

Lennander's case reported by Zachrisson:[22] Male, aged 21 months. Retention of urine and cystitis came on after operation for phimosis. Suprapubic cystotomy disclosed a diverticulum. A fistula was established by sewing the bladder to the skin of the abdomen. In a second operation a strong silk thread was passed through the septum and the diverticular orifice and tied tight in order to cut through. In a third operation a strong curved forceps was applied to the septum and an opening was made by gradually tightening the forceps. Patient left hospital with 200 c.c. residual urine and cystitis. When seen 18 months after operation cystitis was still present. At postmortem, according to Lennander[23] the left kidney was found to have double pelvis with two ureters which ended in the diverticulum. The right ureter and the urethra were found in the bladder proper. Abscess in kidney.

(*i*) Suprapubic drainage.

Englisch's[24] case: Male, aged 60. Prostate somewhat enlarged, particularly the middle lobe. Diverticulitis. Suprapubic cystotomy; drainage of diverticulum for seven months; pain disappeared but diverticulum remained unchanged.

Strauss'[25] case: Male, aged 29. Frequent urination for years, worse since age of 27. Suprapubic incision disclosed two thin-walled sacs communicating with the anterior wall of the bladder. Incision of sacs; drainage. Cure. Strauss describes this as a case of triple bladder—a congenital malformation. Englisch (*l.c.*) comments upon it as a case of diverticula of the bladder.

Fischer's[26] case: Male, aged 75. Suprapubic cystotomy; drainage of diverticulum. Improved. Death one year later from uræmia, pyelonephritis.

Wright's[27] case: Male, aged 38. Suprapubic cystotomy revealed a hypertrophied bladder, with which communicated a diverticulum. The latter was four times the size of the bladder and its orifice of communication was near the right ureter. Drainage. Death.

(*j*) Perineal drainage of diverticulum behind the prostate.

Cholzoff's[28] case. Male, aged 26. Cystoscopy; diverticulum on left side. Suprapubic cystotomy and perineal incision; left ureter which terminated in diverticulum was transplanted into an opening made in the bladder; diverticulum drained through perineum; bladder stitched to skin suprapubically. In a second operation an attempt was made to remove the diverticulum, but without success. Through suprapubic cystotomy the mucous membrane at the neck of the diverticulum was then cut through and the edges closed with catgut; suprapubic drainage of bladder and perineal drainage of diverticulum. Sutures gave way and diverticular orifice reopened. In a third operation the suprapubic fistula was closed and an extraperitoneal fistula curetted. All urine passes through perineal fistula.

Etiology and Pathology.—By diverticula are meant those limited protrusions or bulgings of the bladder wall which only affect a small portion of the periphery of the latter.

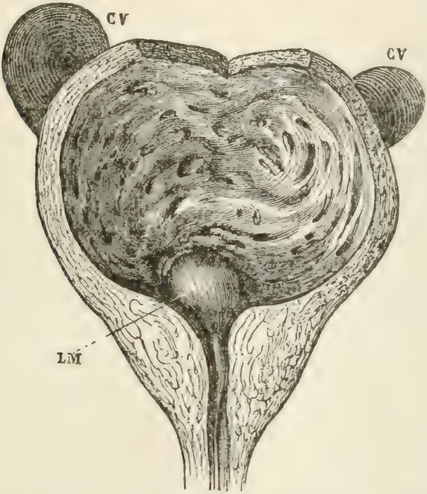
Of the older writers Heister used the designation diverticulum; Morgagni, Saccus; Walther, hernia vesica; Cruveilhier, hernia tunicaire de la vessie. Of other synonyms can be mentioned vesica bipartiti; vesicæ accessoriæ; cystocele interna (Chopart); vesica supernumeraria, etc.

Englisch[29] divided diverticula of the bladder into those: (a) whose walls consist of muscular fibres and mucosa (Taschen); (b) whose walls consist of mucosa only (Zellen).

The former variety is also called congenital, the latter acquired diverticulum. Sugimura[30] following Aschoff unfortunately uses the terms true and false diverticula in the sense corresponding respectively to " taschen " and "zellen." Orth[42] understands by a false diverticulum a perivesical cavity that communicates with the bladder but that has none of the coats of the latter; it is usually formed by a perivesical abscess that has ruptured into the bladder, and whose walls consist only of dense connective tissue. Such cases have been described by Targett and one reported by Billroth,[31] Voillemier and Le Dentu (cit. by Englisch) used the names cellules et poches.

Fano[32] calls both varieties cellules vésicales, and he mentions the following synonyms, kystes, chatons, appendices, poches, and cavites accidentelles. In his description Fano calls the small depressions little cellules, and the two large ones large cellules (Fig. 8). Civiale (cit. by Fano) distinguishes between cellules contractiles and cellules non-contractiles according to the presence or absence of muscular tissue in the wall of the diverticulum.

FIG. 8.



Diverticula symmetrically placed with regard to each ureter. (After Fano.)

Targett[33] and Harrison[34] describe saccules and refer to pouches as mere depressions. Hodgson[35] speaks of pouches and refers to the saccules as merely the early start of the pouch.

Cases similar to the one reported by me in this paper have been described in recent German and French literature as congenital diverticula of the bladder.

The usage of the terms seems somewhat confusing and therefore in the following I apply the term diverticulum to both varieties, simply distinguishing the one with a coat of muscularis and mucosa as a "muscular diverticulum," and the other whose wall has mucosa only as a "mucous diverticulum."

Taschen (the muscular diverticula), according to Englisch, have certain seats of predilection, namely: (1) on the lateral walls of the bladder near the ureteral orifices; (2) toward the base of the bladder above the interureteric bar; (3) at the summit corresponding to the region where the urachus enters the viscus. They occur mostly singly, and most frequently near the left ureteric orifice, but two or more may be present in the same bladder. Englisch ascribes the reason for this predilection to anatomic causes. The longitudinal muscle bundles on both sides of the urethral orifice leave a space free, which is only covered by the circular and oblique muscle bundles—a locus minoris resistentia—and in case of intra-uterine obstruction to the outflow of urine, a diverticulum may develop at this weak spot. Englisch [36] [37] has repeatedly observed such obstructions in the new-born, often due to agglutination of the epithelial lining of the urethra. If the obstruction is merely of short duration the wall may just become pushed out a little at this spot, sufficient, however, to lessen its power of resistance. The further development may occur later in life, when again obstruction to free micturition arises, causing hypertrophy of the bladder wall and the formation of the diverticulum. Such development of the diverticulum may also take place without hypertrophy of the bladder wall. Where the diverticulum is congenital, the bladder is rarely found trabeculated. When a diverticulum is present in a hypertrophied bladder, trabecula may also be present in the diverticulum. Another seat of predilection is the top of the bladder. Two different types may develop here. The one consists of a dilatation of the vesical end of the urachus, which has remained patent. It has thin walls of circular and longitudinal muscle-fibres, and a mucous lining bearing more resemblance to a serous membrane. Its form is apt to be cylindrical. The other type is a dilatation of the upper part of the bladder close behind the urachus; the formation of this Englisch explains as being due to the longitudinal muscle bundles immediately surrounding the region of the implantation of the urachus having thinner and wider meshes, while the circular fibres seem more strongly developed. The least frequent seat of the muscular diverticulum is above the interureteric bar, where they are found mostly in the presence of hypertrophy of the bladder in consequence of an enlarged prostate. The width of the diverticular orifice varies from 1 to 10 cm.; the thickness of the margin of the opening from 1 to 8 mm. The orifice may be circular or oval. This variety of diverticulum has been observed as large as six times that of the normal bladder.

Zellen (the mucous diverticula), according to Englisch, are of relatively common occurrence, as they come on in consequence of those disturbances to the outflow of urine, with which is connected hypertrophy of the muscular bladder wall—most frequently hypertrophy of the prostate. The depressions between the hypertrophied muscle bundles or trabecula correspond to the interstitial connective tissue. Early in its development the mucous diverticulum may have in its wall, beside the mucous membrane, the outer muscular layer of the bladder, but with the growth of the sac the muscle fibres are pushed aside and the wall consists of mucosa only, with muscle fibres around its neck and a little beyond. The width of the orifice of the diverticulum varies from 2 mm. to 2 cm. or more. In size these diverticula range from that of a pea to the size of the bladder or larger. It may occur singly or in large number; Englisch has seen a bladder with 40 diverticula, of which 28 contained calculi. This form does not show the regularity in distribution of the former variety. It is, however, mostly formed on the posterior wall from above the interureteric bar toward the summit, and on the side walls above the ureteral orifice toward the summit. It is rarely found on the anterior wall.

Targett[33] describes sacculi as protrusions of mucous membrane through the muscular coat of the organ in consequence of some mechanical obstruction to the outflow of urine. They occur mostly singly, but two or three may be present. If two are present they are often symmetrically placed with regard to each ureter (Fig. 8); such a case is also reported by Sugimura.[38]

They have narrow mouths and may occur at any part of the bladder except the trigone, but are most frequently met with toward the base. The explanation may be that the felting of the muscular fibres is here most interrupted by the entrance of the large vesical arteries. Targett demonstrated a specimen in which the right ureter terminates in the sacculus, owing to its formation at the spot where the ureter perforates the vesical wall, and the gradual shifting of its orifice.

Pouches, according to Targett, consist of an irregularly shaped protrusion of all the vesical coats more or less thinned by distention. They have wide mouths, and not infrequently result from the pressure of a vesical calculus.

Harrison[34] gives as causes for the formation of sacculi (1) intra-uterine, (2) obstacles to micturition, (3) traumatic. He describes pouches as mere depressions in the most dependent portion of the bladder in which the whole thickness of the wall is involved.

Buckston Browne[39] suggests the following division: (1) the ordinary sacculi, (2) the post-trigonal pouch, and (3) the post-prostatic or trigonal pouch. Both the latter varieties usually hold calculi. Browne reports cases of post-prostatic pouches of considerable size containing calculi.

Hodgson[35] explained the formation of pouches as follows: In cases of long-continued obstruction to free evacuation of the urine, the bladder becomes gradually dilated as the amount of residual urine increases in quantity, and the muscular coat is hypertrophied in proportion as the impediment to free micturition progresses. As the musculature becomes hypertrophied, the fibres gather into bundles between which are seen depressions of the mucous lining when the viscus is contracted. If the obstruction continues to advance, the residual urine to accumulate in larger quantities than is consistent with further general dilatation of the viscus, and the muscular coat begins to act with increased power, the efforts to micturate unavailing to expel the whole of the fluid forward cause the expulsive force to act on the bladder. The residual urine now dilates the little depressions by degrees into pouches, which become larger and larger as the disease progresses, until they may attain even the size of a man's fist. This process extends over a long course of time. Internally, each pouch is lined with the displaced mucous membrane; externally, its wall is formed by submucous fibrous tissue, thin and dilatable when the sac is small, hard, gristly, and resistant for the most part when large. In addition there is a peritoneal covering where this membrane is reflected. Generally speaking the size of the pouches is in inverse ratio to their number, being either small and numerous or large and few.

Young [8] found that in all of the cases that had come under his observation, either operated upon by him or seen post mortem, the walls of the diverticula contained muscle in varying degree, even in those due to obstruction late in life.

The largest diverticulum on record is that reported by Warren Greene.[40] Male, aged 84. Prostatic hypertrophy. Postmortem revealed a hypertrophied bladder communicating through an opening on its left side with a diverticulum which held about one gallon of limpid urine. There was no muscular tissue in the wall of the diverticulum.

The following interesting case of Holmes [41] is included here because it shows that a mucous diverticulum may also form in utero. In a newborn, otherwise well-built boy was found a protruding belly. Death in eight days. Postmortem showed great defect in the musculature of the belly. The kidney substance, particularly on the left, had greatly disappeared, and the ureters were distended and tortuous. The bladder consisted of two sacs, of which one had the ureteral orifices and the urethra, which were patent. The wall of the bladder proper was greatly hypertrophied—three times thicker than normal. The second sac, occupying the right side of the pelvis directly under the skin, was round and of the size of the bladder, with which it communicated through an opening half an inch wide. Its wall was thin and had not a trace of muscle fibres. Cause of death said to be obstruction to urination.

The conclusions, in regard to the etiology, to be drawn from the foregoing are that both the muscular and the mucous diverticula may form before birth and also that they may both develop later in life; but in either instance they are formed in consequence of some obstacle to the outflow of urine.

The presence of muscle in a large diverticulum does not seem to be a proof of the congenital origin of the latter, as maintained by Englisch and others, because muscle tissue has been found present in large acquired diverticula. The termination of one of the ureters in the diverticulum is by some considered a proof of the anomaly being congenital. The specimen demonstrated by Targett, however, shows the ureter terminating in a diverticulum due to obstruction to micturition caused by an enlarged prostate.

In my own case it is possible that the fibrous changes in the neck of the bladder have been the slow cause of the trabeculation of the viscus and of the formation of the diverticulum. The trabeculation of the bladder proper, the absence of trabecula in the diverticulum, and the shape of the orifice of communication would rather be in favor of the view that the diverticulum has originated late in life. The almost straight lower margin of the diverticular orifice suggests that that shape has been determined by a hypertrophied bundle of muscle, and that the formation of the diverticulum therefore has taken place secondarily to the trabeculation caused by the obstacle to urination. If that is the case the vesical end of the ureter has simply become gradually shifted into the diverticulum in the course of its development by pressure. The anlage, however, may have been congenital in the sense regarded by Englisch.

An entirely different view is taken by Pagenstecher, who considers the muscular diverticulum an anomalous embryonal development—due to a superabundance of tissue. There are apparently no better proofs for the theory advanced by Pagenstecher than for the former.

Inflammation is a grave complication in case of diverticulum. Cystitis may be primary and extend into the sac, causing diverticulitis or *vice versa*. Most diverticuli have thin walls and little if any power of contraction. If the sac is dependent and the orifice of communication with the bladder small, stagnation is favored, and with inadequate drainage the pathologic process is progressive. Peritonitis or pelvic abscess may follow diverticulitis, and thrombosis of vessels may occur as reported in a case by Murchison.[43] A large diverticulum may compress surrounding organs and cause damage, particularly to the ureters, and in consequence to the kidneys, causing hydronephrosis, later by ascending infection pyelonephritis and pyonephrosis. Calculi are at times found in the diverticula and cases of new growth in the sac have been reported by Targett,[44] Young,[45] and Perthes.[46]

Symptoms.—A diverticulum may be present in the bladder without giving rise to symptoms, and it may be accidentally discovered postmortem. There is no pathognomonic symptom of this disorder, but the most characteristic one is perhaps that the patient after urination feels as if the bladder had not been completely emptied, and he is able almost immediately to repeat the act, voiding a considerable quantity. This is explained by Hodgson in the following way: The orifices of the vesical pouches are bounded on all sides by bundles of muscular fibres, very much hypertrophied. When the bladder is filled with fluid the hypertrophied muscle bundles are flattened out over the surface, and the orifice of the pouch is rendered patulous. As the urine is being expelled, the general muscular coat performs active contraction, its fibres aggregate themselves into separate bundles, which are gradually approximated to each other, those of them which bound the orifices of the pouches acting as sphincters and shutting up a certain quantity of urine, which is poured into the pouches in the reaction backward of the expulsive force due to the obstruction in front. Thus the diverticulum is filled with urine and its neck is simultaneously closed by contracting muscle bundles. After the urine has been evacuated from the bladder the contracting muscular coats relax and the urine confined in the diverticulum flows out.

Sometimes there is painful urination, particularly in large diverticula. In several instances tumor has been felt above the symphysis or per vagina or rectum. However, it is with the advent of complications, especially inflammation, that a diverticulum gives rise to symptoms. Cystitis and diverticulitis is the most frequent complication and is accompanied by the usual train of symptoms, *i.e.*, painful and frequent micturition of turbid, sometimes stinking, urine. Hæmaturia may appear early before diverticulitis is present, due, perhaps, to circulatory disturbances from distention. In my own case there was early in the history a diverticulitis of a more chronic type, with periodical discharge of large quantities of slimy pus, followed later by an acute exacerbation. Sometimes, in a case of long standing, the secondary kidney disorder may overshadow the bladder trouble.

Diagnosis.—The introduction of a catheter immediately after the patient has urinated will usually disclose a considerable quantity of residual urine. By the aid of the cystoscope the opening into the diverticulum may be found, and a ureteral catheter may be introduced into the latter to roughly estimate the depth. If the opening into the sac is sufficiently large, the cystoscope can be introduced through it and the interior of the sac inspected. The diverticulum may be measured with my rubber bag as described above, and then palpated bimanually while distended. Radiographs taken in lateral and frontal view, after filling the bladder with a 5 or 10 per cent. collargol solution, are of the greatest value, especially where cystoscopic examination cannot be carried out.

Prognosis.—According to Englisch the mortality rate in cases of diverticulitis is 83.1 per cent. The results of palliative treatment and operative treatment other than radical operation have not been encouraging. In the fifteen cases radically operated upon there has been one death.

Sex.—Most cases of vesical diverticula reported have occurred in males, but there are several cases of diverticula in females on record. A very large diverticulum was found postmortem in a woman 59 years old, reported by Hofmokl.[47]

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PRIMARY TUBERCULOSIS OF THE PENIS.*

I. A REPORT OF TWO CASES OF PRIMARY TUBERCULOSIS OF THE PENIS FOLLOWING NON-RITUAL CIRCUMCISION.

BY GEORGE H. WILSON, M.D.,

OF ANN ARBOR, MICH.,

Formerly Staff Assistant in Pathology, in the University of Michigan.

II. NOTE ON PRIMARY TUBERCULOSIS OF THE FORESKIN.

BY ALDRED SCOTT WARTHIN, M.D.

Professor of Pathology in the University of Michigan.

PRIMARY tuberculosis of the penis is a very rare condition. Many authors upon diseases of the genito-urinary system do not mention it at all. It is stated in Watson and Cunningham [1] that primary tuberculosis of the meatus, urethra, or glans probably does not occur, and that when the disease appears at these points it is secondary to other foci higher up in the urinary tract. Keyes [2] states that tuberculous ulcers may appear upon the glans, or result from infection during ritual circumcision. White and Martin [3] state that tuberculous ulcers on the penis are extremely rare, and that they cannot be distinguished from chancroidal lesions by inspection. They have, however, a history of very slow extension; they are usually associated with tuberculous lesions in other parts of the body, sometimes exhibiting about the periphery of the ulceration grayish semitransparent miliary tubercles, and on microscopical examination of the scrapings of the lesion often show tubercle bacilli. Moreover, inoculation of guinea pigs will disclose the true nature of the lesion. They also state that a differential diagnosis can be made only by auto-inoculation; a valuable means of determining the presence or absence of the chancroidal virus, but one which is not infallible. Its value is perhaps best formulated by stating that the majority of chancroids will produce ulcers of a similar type in inoculation, while the majority of other ulcers, syphilitic, tuberculous, or inflammatory, will not produce such lesions.

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*From the Pathological Laboratory of the University of Michigan, Ann Arbor.

Verneuil,[4] in 1883, expressed the opinion that primary genital tuberculosis which did not depend on scrofula was probably caused by direct infection during coitus. Poncet[5] reported, in 1890, to the French Congress for the Study of Tuberculosis an article on "Tuberculosis having its Origin in the Penis." He mentions three varieties: (1) balanopreputial tuberculosis; (2) tuberculosis of the mucous membranes, this variety usually showing itself first in the deep urethra; (3) tuberculosis of the urethra in the form of fungous masses involving the periurethral tissues.

Kraski[6] observed on the dorsum of the glans penis of a patient aged forty-nine years an ulcer the tuberculous nature of which was demonstrated microscopically after removal.

Senn[6] believes that in many cases of destructive lesion treated by amputation of the organ and in which no recurrence followed the operation, the disease was not carcinoma but tuberculosis. He reports the following cases:

Case I.—John M., age thirty-one, with no history of a syphilitic infection. Ulcer first began on the external surface of the prepuce. There was no enlargement of the glands at the time. The ulceration and sloughing extended successively to the glans and body of the penis and finally resulted in almost complete destruction of the entire organ. Later the inguinal glands and skin covering the scrotum became involved. These glands became caseous and several well-marked tuberculous abscesses developed. The discharge from the extensive ulcerating surfaces resulted in inoculated tuberculosis which covered considerable of the gluteal regions on both sides. Some of the ulcers would heal from time to time, after which the new scar would again break down to give place to an ulcerated process. No signs of syphilis could be detected on any part of the surface of the body or in any of the internal organs. The patient was subjected repeatedly to anti-syphilitic treatment, preparations of mercury and iodine were given without improvement; in fact, such treatment aggravated the local conditions and still further impaired the general health of the patient. The patient was then placed on anti-tuberculous treatment, local and general, consisting in the use of balsam of Peru followed by iodoform with repeated curettage and the internal administration of guaiacol and cod-liver oil. The disease was arrested, the ulcers healed rapidly, and the general health so much improved that the patient resumed light work.

Case II.—Emil S., single, white, florist, German, age twenty-one years. In this case the lymphatic glands in the groin became involved, after a considerable portion of the penis had been destroyed by ulceration and sloughing. Syphilis was suspected, but most energetic treatment made no impression on the progress of the disease. Local and general anti-tuberculous treatment with complete excision of all the infected tissues effected a speedy and permanent cure. The tissues were examined for tubercle bacilli with negative results, but isolated multinuclear giant-cells were found.

The diagnosis of tuberculosis upon the evidence set forth in the two preceding cases cannot be accepted as positive. Multinuclear giant-cells are also found in syphilis and would not aid in the diagnosis. Senn bases the strongest argument for the diagnosis of tuberculosis in the fact that rigorous anti-syphilitic treatment not only failed to arrest the disease, but resulted in aggravation of the local conditions and impairment of the general health of both patients, while the anti-tuberculous treatment yielded the most prompt and satisfactory results.

The great majority of cases of primary tuberculosis found in the literature have arisen from ritual circumcision. The ceremony [7] may be briefly described as follows:

The rite is performed among the Jews by a Mohel or surgeon, and may be divided surgically into three parts.

1. The Milah: The child is placed upon the grandfather's lap, the Mohel grasps the prepuce, draws it forward and places it in a slit shield, and cuts it off with a single stroke of the knife.

2. The Periah: The inner lining covering the glans is then stripped back with the thumb and index-finger of each hand until the glans is exposed.

3. The Mezizah: The Mohel takes some wine in his mouth and applies his lips to the penis, exerts suction, spitting the blood and wine into a receptacle; the hemorrhage is afterward

controlled. This was commonly practised by Jews until some years ago, when at Krakow a great number of children were infected with syphilis. It was traced to a Mohel who had contracted the disease; and after this the use of a glass cylinder was introduced, so that the Mohel should no longer touch his lips directly to the wound.

The following cases of tuberculosis following ritual circumcision have been collected from the literature:

MELECOT[8] reports the following case:

A Jew, age fourteen years, was circumcised when eight days old according to ritual. The ulcer was first noticed when patient was thirteen years of age on the glans penis circumscribing the meatus. The edges were dentated and slightly discolored. The base was pale and smooth, there was no formation of pus, and there was no pain on pressure. The patient's face was pale, there was emaciation, but no pulmonary lesion was found. The patient was taken to the Pasteur Institute, and fragments of the ulcer were removed and examined for tubercle bacilli; none could be found. The fragments were then mixed with 4 c.c. of sterile water and guinea pigs were inoculated; these developed tubercles. When the case was seen one year later, the ulcer was in the same condition but the general condition was better.

LINDEMANN[9] reports two cases as follows:

The operator, the same in both cases, came from a tuberculous family and died of the same disease two months after infection of his cases. The cases are as follows:

R. S., parents healthy. Circumcised on the eighth day after birth. Wound healed within two weeks except a small area near frenum, which developed irregular edges and a cheesy base in which miliary tubercles could be seen. The ulcer was healed, but the buboes were removed and pus and cheesy matter evacuated. Recovery followed, but at the age of three years spondylitis developed with compression myelitis, and death followed from phthisis.

L., this case was identical with the first case. However, at the age of one year a cold abscess developed over the wrist.

LEHMANN[10] reported ten cases, all inoculated by the same operator, who died afterward of phthisis. Of these cases six infants died, three of tuberculous meningitis, one of marasmus, after suffering an entire loss of the skin investment of the penis from gangrene, one from sepsis, and one from an intercurrent disease, diphtheria.

HOFMOKL[11] reports a case as follows: Infant circumcised when eight days old; seven weeks later an ulcer developed by the side of the frenum, with a bilateral suppurative adenitis. No tubercle bacilli were found, and anti-syphilitic treatment was begun. This treatment was without effect. The ulcer was then curetted and the glands removed.

On section they showed tubercle structure, and the bacilli could be stained. This patient recovered.

Elsenberg[12] reports the following case: S. P., aged five months. Ulcer developed near frenum, with infiltration extending into the prepuce. The inguinal glands were very much enlarged, and the overlying skin was livid, boggy, and perforated. The discharge from the sinuses was watery and contained flocculi. Later an abscess developed behind the mastoid. Mercury was prescribed without effect. The wounds remained open, and a temperature of 104° F. developed. Death took place from sepsis. No postmortem could be obtained, but section of the prepuce and glands showed tubercles and tubercle bacilli. The same author reports three other cases which recovered.

Willy Meyer[13] reports a case as follows: Infant born in Roumania, ritually circumcised, came to this country at seven months of age. The parents said the child had been treated for syphilis since the disease started. This treatment was continued for a month longer without results, and then all diseased areas were removed. On section the specimen showed tuberculous tissue and tubercle bacilli. Recovery followed in this case.

Karewski[14] has reported three cases; one died of sepsis.

Martin W. Ware[15] reports the following case: C. M., an infant three months of age, born of healthy parents, circumcised according to ritual when one week old. The wound did not heal, but became inflamed, and the inguinal glands enlarged. The child was placed on anti-syphilitic treatment for two weeks without effect. The right inguinal glands became very much enlarged, and, in the site of circumcision, an ulcer with irregular edges developed. The base contained flabby granulations, with a scant secretion. The rectal temperature rose to 103° F. The ulcer was then curetted, the buboes incised, and an ounce of pus removed. The anti-syphilitic treatment was continued. The wound became worse, the penis enlarged, and a lymphangitis, starting from a small yellow nodule, developed from its dorsum. The diagnosis of tuberculosis was then substituted for that of syphilis, and later confirmed by section of the inguinal glands, which showed distinct miliary tubercles.

Dobrovits[16] also reports a case of tuberculous ulcer following circumcision according to ritual; and in a similar case reported by Perlis,[17] complete destruction of the penis took place.

The following case has been reported by Dr. Sara Kelt-Kakels:[18] Baby, age six months, breast fed, born of healthy parents who had one other child, three years of age and healthy. Was circumcised according to ritual at nine days. The wound was sucked by the operator, who was an elderly man and who had followed his occupation for thirty years. He had a cough, and presumably had tuberculosis. After the operation the wound inflamed and the surrounding part became red and swollen. The child became feverish, and suffered from a slight dyspeptic disturbance. About four weeks later the mother noticed a swelling in the left groin. A physician was then consulted. He prescribed an ointment, but no improvement followed. The child was later taken to Mt. Sinai Dispensary. At this time the child showed a small hydrocele on the right side and a glandular swelling in the left inguinal region. Some weeks later the woman returned, and the prepuce of the child looked at this time œdematous, and there was a slight nodule to be felt in the periphery. Fluctuation was detected in the glandular swelling. This was aspirated and a thin serous discharge mixed with flocculi escaped. A suspicion of tuberculosis was then entertained, and Pirquet's was positive. Dr. Eugene Paul Bernstein examined the discharge from the sinus and reported the presence of tubercle bacilli. Later the enlarged suppurating glands were removed by Dr. Charles Goodman, and the pathological examination showed tuberculosis. The baby was well fed, weighed 19½ pounds, and looked rosy and healthy. The temperature was normal, thoracic organs were normal except a few râles over the lungs, the spleen was slightly enlarged, and there was a deep sinus in the left inguinal region, which was gradually filling up with healthy granulations.

The two cases of primary tuberculosis of the penis which I desire to report followed non-ritual circumcision, and are examples of wound infection by the tubercle bacilli. Both cases were carefully studied by Dr. A. S. Warthin, Professor of Pathology of the University of Michigan, and the diagnosis of tuberculosis made after section of the removed tissue. The cases are as follows:

On April 16, 1902, J. S., thirteen years of age, and younger brother, American by birth, family and personal history negative, were circumcised non-ritually by the same surgeon, at the same time and at the same place, where just previously an operation on a tuberculous patient had been performed by the same surgeon. At the end of a week the wounds had almost healed, and both cases were dismissed as cured. Fifteen days later both boys noticed a marked swelling of the tissues of the penis, posterior to the glans, in the line of the incision of the operation. In the case of J. S., the swelling continued until it became the size of a hen's egg. The swelling was opened at various points by the attending physician, and pus was evacuated, and flax-seed poultices were applied. On May 26, 1902, the patient was admitted to the hospital of the University of Michigan. At the time of admission most of the swelling of the penis was on the ventral aspect of the organ. No fluctuation could be detected. The small incisions about the line of circumcision gave off a small amount of yellow pus. There was swelling in the region of the epididymis of the left side about the size of the little finger, soft, but not painful, and the glands of the inguinal region became swollen, but not tender.

Dr. C. G. Darling, Clinical Professor of Surgery of the University of Michigan, dissected away as far as possible the diseased tissues, curetted the granulating surfaces, and brought the edges together with black silk. The tissue was sectioned, the diagnosis of tuberculosis was made by Professor A. S. Warthin. The patient was discharged, cured, July 4 of the same year.

The younger brother was operated privately by Dr. C. G. Darling. The ulcer was curetted after removal of the diseased tissue and treated in the same manner as the first case. The ulcer healed after the first operation, and the patient was discharged as cured. The diseased tissue was sectioned and showed tuberculosis. Bacilli were found in small numbers. The diagnosis in this case was also made by Professor Warthin.

At the present time, nine years later, both boys are living and well, and have shown no signs or symptoms of tuberculosis since the operations occurred.

CONCLUSIONS.

First. That though primary tuberculosis of the penis is comparatively rare, it is probably more common than might be judged from the literature.

Second. It is possible that many cases of primary tuberculosis of the penis have been mistaken for syphilis, chancroid, and cancer.

Third. That tuberculosis following ritual circumcision is less common at the present time than formerly, and no doubt due to changes in the ritual; and that the practice of suction should be abolished.

Fourth. The two cases which I have just reported are due to unclean surgery. The tubercle bacilli were evidently carried from the patient who had been operated upon just previously to the wounds of both circumcised patients by unclean hands or improperly sterilized instruments or other articles used in the operation. Both cases are examples of wound-infection by the tubercle bacilli. That both boys were well and had at no time shown any symptoms or signs of tuberculosis up to the time of operation; that the parents were both well; that the operations were performed by the same surgeon, at the same place and time; and that preceding the operations a tuberculous patient had been operated, leave no room for doubt concerning this mode of infection.

II. NOTE ON PRIMARY TUBERCULOSIS OF FORESKIN.

Since Dr. Wilson's report was written one case of primary tuberculosis of the foreskin has been sent to this laboratory for examination.

CASE 749–N.—Private patient of Dr. D. M. Cowie, young adult, teacher, good family and personal history. No other evidence of tuberculosis. No sexual exposure. Personal habits and character beyond suspicion. No known possibility of infection. Small, painless nodule developed upon the foreskin. Circumcision by Dr. Cowie.

The mucous surface of the foreskin presented a flattened induration about 1 cm. in circumference and 5 mm. in thickness. There was no ulceration. On microscopical examination, the indurated area was found to be composed of a mass of typical miliary epithelioid tubercles with caseating centres and giant-cells. The histologic appearances were in no way like those of a chancre; the individual tubercles stood out sharply with relatively little inflammatory reaction about them; the main portion of the mass being made up of confluent miliary tubercles. The epithelium was intact; and the process was more subepithelial, that is, deeper than a chancre. A nerve ending and a relatively large nerve-trunk lay in the middle of the mass of tubercles. Some of the neighboring veins contained organizing thrombi. The epithelioid areas were completely avascular; and, as a final proof, tubercle bacilli were demonstrated in numbers in the caseating centres. Small beginning tubercles were also found in the walls of the neighboring veins. The largest area of caseation contained numerous polynuclear leucocytes and showed central softening (abscess formation). No other organisms were found, however.

The case must be regarded, therefore, as a very rare instance of the localization of tuberculosis in the foreskin, as a primary process, independent of any local injury. The depth of the process and the vascular involvement make me regard it as most probably a hæmatogenous infection, and not one derived through the mucosa. In the absence of tuberculous lesions elsewhere in the body, or at least of lesions that could be recognized, the process would have to be regarded as a cryptogenic hæmatogenous infection. When last heard from the patient showed no other signs of infection, and the local wound healed promptly.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, Held at the German Hospital, New York, October 25, 1911.

The President, Dr. Charles L. Gibson, in the Chair.

MEMBRANOUS PERICOLITIS.

Dr. Otto G. T. Kiliani presented a man, 28 years old, whose chief complaint was pain, of a " burning, pulling, or dragging " character, in the right lower abdomen. He was constipated, vomited frequently, and had lost weight. He gave a history of having had an appendectomy done four months ago.

Examination showed a scaphoid abdomen, soft, without rigidity. There was a scar in the right lower quadrant, with slight tenderness to the outer side of it. The colon was distended, movable, and easily palpable. A series of X-ray pictures, taken after the ingestion of a Rieder's bismuth meal, showed a dilatation of the colon, and at the end of twenty-eight hours a considerable part of the bismuth paste remained in the gut.

Operation: The colon was exposed through a right rectus incision. It was found freely movable and sharply pinched at its hepatic flexure, descending for a distance of a few inches and then turning upward and across the abdomen. It was bound down here and there by many adhesions and covered with newly-formed connective tissue. The adhesions were separated and the colon anchored with chromic gut sutures to the lateral abdominal wall. The abdomen was then closed in separate layers.

LOCAL BLOOD INJECTION FOR UNUNITED FRACTURE.

Dr. Kiliani presented a man, 29 years old, a chauffeur. In April, 1911, he was struck by a car, sustaining a fracture of both bones of the right leg at their lower third. He was treated at the Roosevelt Hospital for several weeks, and then came to the German Hospital, where a plaster case was applied. He returned to the hospital six weeks later, at which time Dr. F. Kammerer sutured the fragments of the tibia with two silver wire sutures.

An examination made on Sept. 1, 1911, showed that the fractured tibia was still ununited. The patient's leg had been in an extension apparatus, in plaster; he had received Bier's hyperæmic treatment, massage, and mild active motion. The patient was then given 10 c.c. of venous blood, injected into the line of fracture. A similar injection was given on Oct. 7, 1911, and the slight false movement of the fragments diminished decidedly. He left the hospital on Oct. 26 on the road to complete recovery.

Dr. Henry H. M. Lyle said that in the past four months he had seen three cases of non-union after the use of Lane's plates. In two of these cases the plating had been done for non-union.

He had used " Bier's blood injection " with excellent results. Last year he had shown before this Society a case of non-union of both bones of both legs. This case had exhausted all the ordinary orthopædic and surgical methods, yet union was obtained by the injection method in four weeks.

The results in this case and in others had convinced him that this method should always be tried before resorting to the use of Lane's plates. Dr. Kiliani's striking result had deepened this conviction.

DIVERTICULUM OF THE ŒSOPHAGUS DUE TO CARCINOMA.

Dr. Kiliani presented a man, 68 years old, who about ten months ago first noticed difficulty in swallowing, and for the past five months he had been unable to eat any solid food and swallowing gave rise to pain in the neck. There was no history of vomiting, but he regurgitated his food frequently. There was no blood in the stools. The patient had lost eight pounds in weight.

An examination of the neck showed atrophy of the thyroid gland. The thyroid cartilage stood out prominently, and there was a gurgling sound when the patient swallowed. One of the submaxillary glands on the right side was enlarged and hard. A No. 16 French bougie could be passed into the stomach; a No. 22 failed to pass, meeting with an obstruction eight and a half inches from the teeth.

On August 24, 1911, a gastrostomy was done by Dr. Fisher by the Carter-Senn method, and about a month later he made an incision, six inches long, beginning at the top of the sternum and extending obliquely outward on the left side to about the level of the larynx. The œsophagus, in this location, was found to be normal, but below it became lost in a hard tumor mass which extended downward and backward to the vertebral column. It was apparently malignant, and no attempt was made to remove it. The omohyoid muscle, which had been previously cut, was reunited, and the wound was closed with silkworm gut.

ISOLATED FRACTURE OF THE TRANSVERSE PROCESS OF THE FIRST AND SECOND LUMBAR VERTEBRÆ.

Dr. Kiliani presented a man, 33 years old, who complained of a sharp, stabbing pain in the right kidney region, radiating across the back to the opposite side. There was also a constant aching pain on the right side which radiated to the shoulder. The patient denied luetic infection. He gave a history suspicious of pulmonary tuberculosis; otherwise, his personal as well as his family history was negative.

The patient stated that his present history dated back three weeks. He said that four days ago the pains in the back became more severe, and that two days before admission they were "maddening," so that they would double him up. He had vomited several times. There was no blood in the urine; no frequency; no "sand."

In addition to the above history, it was subsequently elicited that seven months ago the patient had fallen a few feet, landing on his back. Following this fall, he had not complained of any pain or inconvenience. An examination of the abdomen was practically negative, and cystoscopy revealed nothing abnormal. Posteriorly, there was a point of tenderness on the right side, two inches from the median line, at about the level of the crest of the ilium. In forcibly landing on his heels, he experienced a severe pain. Bending forward was not limited, but on assuming the erect posture he experienced a severe "catching" pain. Backward motion of the spine was slightly limited; otherwise, motion was not interfered with.

A diagnosis of fracture of the transverse process of the first and second lumbar vertebræ was made, and the exact location of the fracture was verified by the X-ray. Firm strapping of the parts gave the patient only partial relief, and after this method of treatment had been tried for about three weeks, the loose fragments of bone were removed by Dr. Kiliani, with entire relief.

TUMOR OF THE BRAIN.

Dr. Kiliani presented a man, 51 years old, the history of whose illness dated back ten years, when he began to complain of headache and weakness in different joints, especially on the right side. He also had a sense of numbness in the fingers, sudden lapses of memory, and periods of semiconsciousness. He had perfect control of the bladder and rectum. There was no history of vomiting. His vision had gradually become impaired until he was scarcely able to recognize objects. Hearing was normal.

Upon admission to the German Hospital, on June 23, 1911, an examination gave the following chief points of interest: His pupils were equal and reacted sluggishly both to light and accommodation. The fields of vision were contracted, especially the lower, and acuteness of vision was diminished. There was no nystagmus; no paralysis of the extrinsic muscles. There was distinct muscular weakness on the right side of the body; no areas of anæsthesia, but sensation was somewhat impaired. There was no muscular inco-ordination. The knee-jerks were exaggerated, the right more so than the left. There was no Romberg; no Babinski. With the exception of sight, the special senses were not impaired. There was no facial paralysis nor anæsthesia. There was double choked disk.

At a subsequent examination, made on October 12, 1911, the abdominal reflexes on the right side were found to be absent. The Babinski reflex was present on the right side and the knee-jerks were exaggerated. Muscular weakness was marked on the right side, while the sensory reactions on that side were diminished. There was no tremor. The patient was emotional, and subject to fainting spells and attacks of petit mal. There was motor aphasia. No nystagmus.

Dr. George Jacoby made a diagnosis of left-sided brain tumor, starting in the white substance, possibly involving the thalamus and extending outward to the cortex. A decompression operation was done by Dr. Kiliani on October 30, 1911, followed by considerable improvement in the patient's symptoms. Radical removal of the tumor was considered impossible.

SPASTIC HEMIPLEGIA WITH SPONTANEOUS RECOVERY.

Dr. Kiliani presented a girl, three years old, who was admitted to the German Hospital on June 30, 1911, with the history of having been shot in the back with a 42-calibre revolver bullet. The wound of entrance was found in the lumbar region, half an inch to the right of the median line and extending upward and to the left in an oblique direction.

The history obtained was that after receipt of the injury, the child's left side was completely paralyzed. When Dr. Kiliani first saw her, in August, 1911, the only symptoms that remained indicated a partial paralysis of the muscles of the left lower extremity. The leg was flexed and abducted. The patient was now able to raise her foot a few inches from the bed.

EXTREME RECTAL PROLAPSE CURED BY OPERATION.

Dr. Frederic Kammerer reported the case of a woman, 29 years old, upon whom he had operated for a very large rectal prolapse a year and a half ago. The patient had been under his care for over six months, but he had been unable to trace her lately and could not, therefore, speak definitely of her condition to-day.

In the course of her treatment, various plastic operations had been done on the perineum and in the sacral region, the last one being a colopexy, with partial denudation of the left iliac fossa and suture of the sigmoid to the area stripped of its peritoneal covering (denormant), a procedure which had apparently given permanent results in several other cases. In this case, however, six weeks after operation, the patient had a fall while still in the hospital, resulting in a renewed prolapse of the entire rectum. The speaker now resorted to the method described by Quenu and Vidal of obliterating the cul-de-sac by two purse-string sutures, and suturing the bowel to the posterior surface of the broad ligament and the left iliac fossa. As an additional safeguard, he had fastened the uterus to the anterior abdominal wall, which procedure, he believed, was not included in the method of Quenu and Vidal. There had been no recurrence during the period of observation mentioned above.

Dr. A. V. Moschcowitz said that very recently one of the house surgeons of Mt. Sinai Hospital had called his attention to the operation of Quenu and Vidal for prolapse of the rectum, a description of which was published in the *Revue de chirurgie.*

Dr. Moschcowitz said that through the courtesy of several members of the Society he had been fortunate in seeing a goodly number of cases of prolapse of the rectum during the past four or five years. In his earlier cases he did the operation from below, dividing the sacrum and getting at the prolapse by that route. This method was not always satisfactory, and during the past four years he had practically followed the method by Quenu and Vidal, closing up the cul-de-sac of Douglas. In women, he first separated the peritoneum, which gave a far better result than by merely closing the cul-de-sac, and in some of these cases he also added a fixation of the uterus high up.

Dr. Moschcowitz in conclusion said, that he had not as yet read the article in question, and on that account did not wish to enter into a discussion of priority; but he would like to mention at this time that his first case was done nearly four years ago.

DUODENAL ULCER.

Dr. Kammerer presented a man, 33 years old, who had developed all the classical symptoms of stenosis of the pylorus. At the operation, the first portion of the duodenum was found firmly bound down by adhesions, posteriorly, with a stellate cicatrix on the anterior surface, about half an inch from the pylorus. A posterior gastro-enterostomy, done six months ago, had relieved all his symptoms.

Dr. Kammerer also presented a man, 25 years old, who had had a history of eight years' duration, pointing to an ulcer in the duodenum. In this case there were no symptoms of stenosis at the outlet of the stomach. The patient had finally drifted into a state of chronic invalidism, with great emaciation. At the operation, which was done not quite a year ago, an indurated area on the anterior surface of the first portion of the duodenum was found. There were no adhesions. A posterior gastro-enterostomy, followed by a unilateral exclusion of the pylorus, was done. The latter was accomplished by section of the stomach, about an inch and a half from the pylorus, with closure of both ends (Von Eiselsberg).

The patient had gained forty pounds in weight since the operation, and was free from all symptoms. The speaker thought this exclusion, whenever practicable, was preferable to simple infolding of the ulcer by sutures. Where there was no stenosis, some form of closure of the pylorus ought to be practised.

DIVERTICULUM OF THE GALL-BLADDER.

Dr. Kammerer showed a woman of 48 years, who came to the hospital with a well-marked recurring cholecystitis. The operation revealed a rather unusual condition. On opening the abdomen, extensive adhesions were found to the enlarged and very much thickened gall-bladder. After liberating the body of the gall-bladder, a hard, irregular, spherical mass, an inch and a half in diameter, could be felt, resting against the cystic duct on the one side, and firmly adherent to several coils of small intestine on the other. It gave the impression of an enormous gall-stone in migration from the gall-bladder to the intestine. With considerable difficulty the intestines were separated from the mass, a ligature passed around the cystic duct, and the gall-bladder removed with the mass *in situ*. The latter consisted of a shell of calcareous matter, from one-sixteenth to one-eighth of an inch in thickness, with a fairly smooth inner surface, which on microscopic examination proved to be a lining of mucous membrane, the interior being completely filled with a substance of waxy consistency, uniformly tinged with bile. There was, however, no communication between this cavity and that of the gall-bladder proper, at least not at the time of operation, nor could any indication of a previous communication be found.

RESECTION OF THE ŒSOPHAGUS AND LARYNX FOR CARCINOMA.

Dr. Kammerer presented a man, 45 years old, who had been suffering from increasing difficulty in deglutition until he was scarcely able to swallow anything, solid or liquid, and was in a condition of marked emaciation. The stomach tube was arrested at a point corresponding to the cricoid cartilage, and a distinct mass could be felt by external palpation of the neck.

A preliminary gastrostomy was done, and two weeks later, through an incision along the anterior border of the left sternomastoid muscle, the constricting mass in the œsophagus was exposed. In the course of the operation, the entire laryngopharynx and about two inches of the œsophagus proper, the entire larynx, and the left half of the thyroid gland had to be removed. The stump of the trachea was sutured to the skin above the sternum, the pharynx above, the œsophagus below were closed by sutures, and the prevertebral wound cavity was partially tamponed with gauze. The patient bore the operation well, and was now, six months later, in a much improved general condition.

Dr. Willy Meyer showed a series of cases illustrating the end results of various operations after the lapse of from three and a half to ten years.

PERICARDIOTOMY.

The patient was a man, 34 years old, who had been operated on at the German Hospital three and a half years ago. Upon admission to the hospital, the patient was suffering from intense dyspnœa, cough, night-sweats, and œdema of legs. A diagnosis was made by Dr. J. Kaufman of effusion into the pericardium. This was aspirated by Dr. Meyer, and about a quart and a half of dark-colored fluid was withdrawn. This procedure gave only temporary relief, and a week later he was again tapped, and about a quart of fluid evacuated. The relief again was only temporary, and six days later, under local anæsthesia, the sixth and seventh costal cartilages were resected, the pericardium was incised, and over two quarts of fluid evacuated. The heart itself could not be seen until a large number of black coagula were removed. After this there was immediate improvement in the patient's symptoms. Convalescence took nearly five months. The case was considered to have been one of tuberculous pericarditis, and the patient was sent to Liberty, N. Y., where he had remained ever since, and where his health had become entirely restored. (See Annals of Surgery, 1909, vol. xlix, p. 261.)

IMPLANTATION OF SILVER FILIGREE FOR INTRACTABLE ABDOMINAL HERNIA.

The patient was a woman, now 53 years old, upon whom the operation had been done ten years ago, and who had already been shown at one of the previous meetings of the Society. The history dated back twenty years, when at some other hospital the patient had her uterus removed, and the resulting wound was drained with gauze. Following this, a large ventral hernia resulted. She also had a diastasis of the recti above the umbilicus. She was subsequently operated on by Dr. F. Lange, who buried silver wire and silkworm gut sutures, and she remained well about a year and a half.

The patient first came under Dr. Meyer's observation eleven years ago, with a large abdominal hernia, the aperture being between the umbilicus and symphysis; it was too large to be closed by autoplasty; therefore the omentum was pulled down and stitched to the borders of the defect. An abdominal bandage gave sufficient support to enable the patient to attend to her work as cook. About one year later, during an attack of acute intestinal catarrh, a severe vomiting spell tore the omentum loose and the hernia returned. A few months later Dr. Meyer implanted a silver wire filigree imported from Germany. It healed in nicely after a sinus resulting from a fascia necrosis had closed under treatment with pure carbolic acid. The patient seemed entirely cured and could be discharged without a truss in spite of her large pendulous abdomen. Nine months later, on turning suddenly, she knocked this very spot against the corner of a kitchen sink and almost fainted. Examination and subsequent operation showed that the filigree had been broken in its centre but that otherwise it was properly in place. An additional filigree was made during the operation which permanently cured the trouble. She now has been wearing these filigrees for ten years; she has never worn an abdominal supporter and the hernia has never returned. Recently, Dr. Meyer operated for the diastasis of the recti above the umbilicus which had returned in spite of a second operation done by another surgeon. The muscles were separated almost up to the xiphoid process and could not be brought together, and he made a typical filigree with cable silver wire in course of the operation. This hernia, too, seems to be definitely cured.

Dr. Meyer stated that he had done quite a number of operations for defects of the abdominal wall as well as for intractable herniæ by means of silver wire implantation. He emphasized the advantages of the cable silver wire over the German wire. The former is very flexible and does not break so easily. Temporary sinuses, he stated, are best treated with suction cups.

RESECTION OF THE ASCENDING AND TRANSVERSE COLON FOR CARCINOMA.

Dr. Meyer showed this patient, upon whom the operation had been done in November, 1905, six years ago. The patient was a woman, then 57 years old, who had been treated for a long time for cholecystitis, and who had suffered for years from pain in the region of the hepatic flexure. The diagnosis of cancer of the colon was made. Incision through the right rectus showed a large, infiltrating carcinoma, involving the ascending and part of the transverse colon; ileocolostomy was done with the elastic ligature, and the abdomen closed. Five weeks later, median incision; resection of the tumor and inversion of the divided gut on either side of the well functionating anastomosis. She made an uninterrupted recovery, gained rapidly in weight, and, as far as the colon is concerned, has been well ever since. In November, 1908, the speaker had to remove a tumor of the bladder of this patient, which proved to be carcinoma. Bladder and abdomen were closed by layer sutures and a permanent catheter was placed in the urethra. The patient was discharged at the end of two weeks and is to-day in perfect health.

SPLENECTOMY FOR SPLENIC ANÆMIA.

This patient was a man, 41 years old, whose spleen had been removed three and a half years ago. He had been extremely low, and direct transfusion was done by the house surgeon, Dr. Ottenberg, in January, 1908. The effect, though favorable at first, was not lasting. In March of the same year splenectomy became necessary, and was done with the help of osteoplastic resection of the costal arch. The tail of the pancreas (about one-third of the organ) had to be excised with the spleen. The patient made a perfect recovery; and has remained in good health since, being able to attend to his work.

This observation again proves that splenic anæmia is a surgical disease curable by operation. (See ANNALS OF SURGERY, 1909, vol. xlix, p. 258.)

CRANIOTOMY FOR FIBROSARCOMA OF THE AUDITORY NERVE.

The patient was a woman, 23 years old, who was operated on over three and three-quarters years ago, in January, 1908 (ANNALS OF SURGERY, 1908, p. 309, and 1909, vol. xlix, p. 552). She had shown all the typical signs of brain tumor, and had been almost blind, as pointed out at one of the previous meetings. The operation was done in one sitting; a large horseshoe shaped skin muscle flap, which later on had to be divided in the middle, was turned down, thus exposing the occiput. The entire occipital bone was removed, the longitudinal sinus doubly ligated and divided, and the dura mater opened by a heart-shaped incision, the flap being turned down. The cerebellum, thus made movable, was held aside by the brain elevatorium, when in the depth the bluish-gray tumor came nicely into view. It was shelled out with Kocher's "Kropfsonde"; the wound was carefully drained. The dura mater flap could not be brought into apposition again with the upper border on account of the bulging brain, but the skin muscle flap was sutured in place. The patient made a perfect recovery. To-day she shows the signs of a typical decompression operation and wears a leather-covered aluminum plate for protection. She is able to walk alone on the street for long distances, can read and write and do embroidery work, and makes herself generally useful in the household. There is no sign of a recurrence.

PARTIAL GASTRECTOMY FOR CARCINOMA IN A PATIENT 24 YEARS OLD.

The patient was a man, who had entered the hospital greatly emaciated with typical signs of pyloric obstruction; stomach analysis did not point to carcinoma. On opening the abdomen, a large infiltrating tumor was found at the pylorus and many glands alongside the larger curvature; none at the lesser one, near the pylorus, but further away up toward the cardia; it was most difficult to remove the latter. Typical resection of stomach was done and posterior gastro-enterostomy with the button added. Recovery was uneventful. To-day the patient is in perfect condition, having gained considerably in weight.

In connection with this, Dr. Meyer mentioned another case which showed the necessity of resection of the ulcer-bearing area of the stomach whenever possible. He referred to a man at present in the hospital, in whom he had done gastro-enterostomy for pyloric obstruction two years ago. One gland was found in the major omentum on which the laboratory, after a few minutes, reported "no carcinoma." On basis of this, anastomosis was done. At present he is again in the hospital with an inoperable pyloric carcinoma.

SIMULTANEOUS REMOVAL OF RENAL AND URETERAL CALCULUS ON THE SAME SIDE.

The patient, 39 years of age, had had litholapaxy done twice and showed stone in the kidney as early as seven years ago, but refused operation. This summer he again came under observation, with an immense, ramified stone in each kidney. On the left side there was in addition a ureteral stone. Dr. Meyer proposed an operation in two sittings on the latter side, as he considered it safer to first arrange for proper drainage of the kidney and then to operate on the latter. However, patient having no time to lose, insisted on a simultaneous operation. Consequently, after resection of the twelfth rib, the kidney was brought into view, pelviotomy was done, and the lower end of the stone broken off, on purpose. Then the section cut was added and the other ramified portion removed; finally, two smaller, separate stones were cut out of the parenchyma. There was no suppuration at all; the kidney tissue tightly embracing the calculus, it could be gently stripped off without much injury. The pelvis was sutured as well as either pole of the kidney, and the centre of the section cut drained; after proper dressing, the patient was turned around and extraperitoneal left ureterotomy added. The stone was found near the bladder (as the X-rays had demonstrated); after proper incision, it could be well developed; the ureter was then sutured. The patient made a good recovery, left the hospital in about three weeks and wants to wait—against advice—for the removal of the right renal calculus until next spring.

Here again the needle holder, the so-called "Küster's swan," as improved by the author and published in the ANNALS OF SURGERY, July, 1910, in a paper on thoracic surgery, proved of greatest advantage. Although, as it has been pointed out in an article by Wm. J. Mayo recently, that the ureteral wound can be left open in such cases, his patients having made good recoveries, it nevertheless seemed advisable to the speaker to close it. He stated that so far he had been able to close every ureteral wound of this kind, even in the closest proximity to the bladder. High Trendelenburg's posture and this needle holder allow the work to be done.

TRANSDUODENAL CHOLEDOCHOTOMY.

This patient, 25 years old, was operated upon in June, this year. She had had many attacks of biliary colic and became jaundiced early in May. Operation June 29: Rectus incision; cholecystostomy; stones removed; choledochotomy; removal of stones; one calculus low down could not be pushed up into the wound in the common duct; duodenal incision. A stone was found tightly wedged in the papilla Vateri, half in the duct, half in the duodenum; duct incised; stone removed. A probe introduced through the choledochotomy wound showed patency of the duct; double layer suture of the duodenum; suture of the common duct; drainage of the gall-bladder. Patient made a good recovery and is to-day in perfect health.

THORACOTOMY FOR IMPERMEABLE CARDIOSPASM (TWO CASES) WITH REMARKS ON DRAINAGE AFTER INTRATHORACIC OPERATIONS.

Dr. Willy Meyer stated that a few months ago he had published in the *Jour. of the Am. Med. Ass'n,* a case of impermeable cardiospasm in a woman, 47 years old. She had a very large pouch above the diaphragm. Thoracotomy was done under differential pressure; both pneumogastric nerves were widely separated from the œsophagus and the latter's pouch reduced in size by a double plication. She made a perfect recovery and was shown before this Society last fall, having gained quite some weight. An interesting point in her history was that she had regained the power of swallowing solid as well as liquid food *without any further intervention.* Seven months later she went through a severe attack of influenza-pneumonia, and not long thereafter developed a thoracic œsophageal fistula, evidently due to one or more sutures having cut through the œsophageal wall. Silk had been used. She refused further operation on the thorax and died a year after the first operation, having retained the ability of swallowing up to the last. Postmortem showed the signs of a posterior suppurative mediastinitis.

Dr. Meyer now presented two further cases of the same kind. In both thoracotomy and single plication had been done with chromicized catgut. The first patient whose cardia had been frequently stretched by competent men, without gratifying results, was today well able to swallow his food, only that in the beginning of his meals he had to take a swallow of water and force the food down with the help of intrathoracic pressure.

In the second case, Dr. Einhorn had diagnosed an organic stricture at the cardia, probably due to a former ulcer, but inasmuch as during the operation the sound passed the cardia, although with some difficulty, a plasty was not done on the cardia, but the operation as mentioned before. Patient made an uninterrupted recovery, but, functionally, he has not been much improved; he is able to swallow liquids, but no solids. It is the speaker's intention, now to first try stretching of the cardia and, if this should prove of no avail, to do a second thoracotomy and perform intrathoracic cardioplasty according to the v. Heinecke-Miculicz method of pyloroplasty.

Dr. Meyer stated that in almost every one of his operations on the œsophagus he observed that a cardia which is not occupied by a tumor could be easily pulled far into the thoracic cavity. He could see no reason why cardioplasty should not be done through the thorax. It certainly must be easier than to turn up the costal arch and work from the side of the abdomen, as Wendel has done.

In both of the last cases and an additional third one before, all three having been operated upon in the negative chamber in the course of May and June this year, Dr. Meyer tried a new method of thoracic drainage which he planned two years ago, at the time of preparing for the building of the new Thoracic Pavilion of the German Hospital. The same consists in closing the original thoracic incision and making another intercostal one in the complementary space for drainage with ordinary rubber drainage tubes. Thus proper exit is provided for the immediate secretion of the pleura as well as any air that may bubble out from a sutured lung wound, as for instance, after an accident. The compression of the lungs by fluid or air, with its possibly fatal consequences, may thus be avoided. Post-operative acute pneumothorax is prevented by continuing the patients under differential pressure for some time after operation, instead of sending them back to the ward. The head rests within the cabinet, where it can be easily reached by doctors and nurses who serve in relays, as the air lock permits of entrance and exit. The patient's body rests comfortably on a bed without head piece, of same height as the operating table. All kinds of stimulation, as rectoclyses and hypodermoclyses, intravenous infusions and hypodermic injections, can be given outside, and, of course, food can be brought to the patient. After having been removed from the apparatus, the patient is kept for about 24 hours in one of the two recovery rooms provided for, which are rather observation rooms, in order to determine whether a reapplication of differential pressure is required.

It is self-understood, that in aseptic cases the thoracic incision is closed without drainage.

Dr. Meyer then demonstrated Tiegel's thoracic metal-drainage tube, as published in the *Centralblatt f. Chir.*, early this year, which he had lately imported. He also mentioned the method of Robinson for the treatment of empyema, who perforates the rib and screws in a snugly fitting trocar cannula, siphon or suction drainage then being established. It is evident, that this procedure can also be used for drainage after intrathoracic operations.

He further referred to the proposition of Green and Janeway, who lately have come forward with a plan of thoracic drainage in experimental surgery, similar to that of his own.

He pointed out, that in the method advocated by himself, the after-treatment of the thoracic wound does not differ from any other wound treatment. He believes that it can be employed with any kind of differential pressure apparatus—provided its use does not require general anæsthesia—inasmuch as his observations so far have shown that a continuation of differential pressure for 12 to 15 hours after the operation suffices to form adhesions between pulmonal and costal pleuræ, strong enough as to permit of the patient's removal from the apparatus.

The manner in which the drainage after intrathoracic operations at the German Hospital is done was then demonstrated during a walk through the new pavilion for thoracic surgery.

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ORIGINAL MEMOIRS.

INDICATIONS FOR AND AGAINST THE OPERATIVE TREATMENT OF SIMPLE FRACTURES.*

BY JOHN H. GIBBON, M.D.,

OF PHILADELPHIA,

Professor of Surgery in Jefferson Medical College; Surgeon to the Pennsylvania Hospital.

WHAT I have to say on this important subject will probably cause my readers to place me among those who oppose the operative treatment of simple fractures; and although I should prefer this to being classed with those who recommend operation in practically every case, yet a careful consideration of what is said I believe will show that I belong in neither class. There has been so much written on the open treatment of simple fractures, and the technic has been so much improved lately, that I am afraid we have become too sanguine in regard to our results and too radical in both our teaching and practice. It is important to bear in mind that what follows has to deal only with simple fractures.

The first desideratum in the treatment of a fracture is the restoration of function, and the first step in accomplishing this objective is complete reduction and retention of fragments. Although improper reduction is one of the chief causes of loss of function, injury of the surrounding soft parts and the resulting adhesion of muscles and tendons is just as potent a factor, and when the open treatment is employed there must be more or less injury and adhesion of these structures, which will be in proportion to the mechanical and technical skill of the operator and the perfection of his asepsis. It is extremely important to bear these facts in mind before undertaking the open treatment of a simple fracture.

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* Read before the Philadelphia Academy of Surgery, December 4, 1911.

There are, of course, certain indications for the open treatment which we all recognize and follow, unless they are outweighed by equally positive contraindications, which will be considered later. In the first place, the situation of the bone or the type of the fracture may be a sufficient indication for operation; this is the case in fractures of the patella, in many fractures near a joint, in an epiphyseal separation which cannot be perfectly reduced, in some comminuted fractures, in those where a muscle or tendon or other tissue is interposed between the fragments, where a nerve-trunk has been caught under one of the fragments, and in all fractures where a fair reduction has not been obtained *after the exhaustion of all rational non-operative means*. Emphasis is laid on this last condition, especially with students and those who look too lightly upon the risks of operative treatment. I say this because it is the beginner or the occasional operator who is often willing to run risks which the most experienced operator never runs, and neglect precautions which an experienced operator always takes.

One of the most valuable lessons which experience teaches is the estimation of risks and the value of precaution. It is the tyro whose boldness causes him to operate where an experienced surgeon recognizes danger, and it is the tyro who considers the refinements of an aseptic technic unnecessary or even looks upon them as fads. It is this type of surgeon who will operate on a fracture without having exhausted the less dangerous non-operative means of reduction, and one reason why he does so is because he sees many worse cases operated on successfully by others. It may be said that this applies to the whole field of surgery, and so it does, but I hold that it applies particularly to the open treatment of fractures, where success depends so largely on the operator's mechanical skill and his practice of an aseptic technic.

A conscientious practice of the rule of exhausting the non-operative means of reduction will obviate the necessity of operation in many so-called irreducible fractures. To prove this statement, one has but to consider a few types of fracture for which operation is frequently employed. First, let us take fracture of the surgical neck of the humerus with abduction and external rotation of the upper fragment, a fracture which by the older methods of reduction and retention gives but a limited restoration of function and a very indifferent restoration of contour. A mistake commonly made here is that of trying to control the short upper fragment, which is practically uncontrollable, instead of placing the lower fragment or shaft in alignment with the displaced and uncontrollable upper fragment. In many of these cases the simple abduction of the arm with moderate traction even without an anæsthetic will result in an excellent reduction, which can be maintained by dressing the part in abduction on a triangular splint placed against the chest wall, the inner aspect of the arm, and the flexor aspect of the forearm; or by keeping up extension in the abducted position by placing the patient in bed and applying a Buck extension apparatus to the arm. Too frequent an error in these cases is that of fixing the arm against the chest wall and applying a bandage, usually a Velpeau, which makes upward pressure on the flexed elbow and downward pressure on the shoulder; in other words, a dressing which tends to crowd the fragments into angulation or to retain them in this malposition. Traction applied to the elbow with the arm against the chest wall also often corrects the deformity when operation may seem to be necessary. In a number of these cases where there was extremely bad position of the fragments, we have obtained a fair reduction and excellent restoration of function by keeping the patient in bed with an extension on the arm in the abducted position for a week or ten days, and then dressing the part on a triangular splint.

Transverse fractures of the humerus with overlapping can nearly always be reduced by continuous traction applied to the flexed elbow, with fixation of the arm to the chest wall while the patient is in the upright position, or, what is better, by keeping the patient in bed and applying extension by means of a Buck apparatus. Counter-extension should be made, of course, by elevating the foot of the bed and fixing the upper arm to the head of the bed by means of a pad and strap passed under the axilla. In the oblique and spiral fractures of the humeral shaft, the type of fracture which most frequently requires operative fixation, the large majority can be reduced by the method just described. If it fails, probably due to the interposition of the soft parts, then operation is plainly indicated. The necessity for operation in supracondyloid and fractures of the condyles can often be obviated by the proper employment of the Jones position, which gives excellent functional results, although not such perfect contour as can be obtained sometimes by other forms of dressing and by operation.

Many fractures of the olecranon require operation because of the wide separation of the fragments and the extensive laceration of the ligaments. But here the simplest means possible should be employed; catgut suture of the ligamentous tissue, as in fracture of the patella, may be sufficient, and a plate in this position is seldom excusable.

In certain fractures of the shaft of the radius and of both bones of the forearm, we encounter some of our greatest difficulties, and may be driven to operation or to accept some deformity with considerable loss of function. In four or five such cases within the past twelve months I have been surprised and gratified to find what can be accomplished by continuous traction extending over a period of from two to ten days. One of the cases at the Jefferson Hospital, X-ray plates of which are shown, was most obstinate (Figs. 1 and 2). My assistant, Dr. Despard, twice tried under ether anæsthesia to reduce this fracture, but the overlapping radial fragments could not be put into line. He then applied a Buck extension apparatus below the fracture, fixed the upper arm to the head of the bed, and elevated the foot of the bed. This treatment, kept up for three days, had little apparent effect on the deformity, and the boy was then anæsthetized with the understanding that I would operate if failure again accompanied efforts at reduction. The treatment had done so much to overcome and stretch the muscles that without much effort reduction was accomplished, and the boy, now eight months after the injury, is playing on a football team, has perfect function, and it is impossible to tell by examining the arms which was the seat of fracture. In another case of overlapping of both bones of the forearm sent into the hospital from the out-patient department, where various efforts had been made at reduction and in which about ten days had elapsed since the injury, treatment by continuous traction for about two weeks resulted in fair reduction and good union. The ultimate restoration of function I have been unable to determine in this case. Other cases have responded much more quickly to the treatment, but these two were cases in which operation seemed inevitable, even after traction had been kept up for several days. This method of overcoming the indications for operation will not work in every case, but it should be tried faithfully before resorting to the open method, which certainly does not give its best functional results in fractures of the forearm and makes a scar which is disfiguring, especially in women. The bones here are closely surrounded by important structures which are apt to become bound down in the cicatrices; the bones are delicate and do not put up with the plates and screws so well as the more deeply situated and larger bones.

The femur is the bone upon which we most frequently have to operate, and yet as the results here cannot always be expected to be perfectly satisfactory, we should by every possible means try to obtain reduction before operating. In children, especially, persistent effort and time will do wonders in restoring the bone to approximately normal lines, and the functional results are often excellent even in the presence of considerable deformity. I have nothing particular to offer here as a means of avoiding operation in the adult, but I would call attention to the fact that in fractures of the upper third of the femur which are so troublesome because of the difficulty of controlling the upper fragment, extension in the abducted and elevated position has not been given one-half the employment it deserves. Most of us use this position in children, but many fail to realize its advantages in the adult. I have had as many as three of these cases in my ward at the Pennsylvania Hospital at one time upon which I have operated, but since I have used the extension with a little more care and discrimination, and less according to rule, I have operated on fewer cases.

Of fractures of the patella I shall say but a word, as I believe that the indication for operation is clear if the fragments are separated, since bony union of the patella and good healing of the lateral ligaments will rarely take place without it. I have never operated on a fracture of the patella without finding the ligamentous tissue firmly adherent over one or the other of the fractured surfaces. The contraindications will be referred to later.

In fractures of the tibia of the oblique and spiral types, operation is frequently demanded, and yet I am confident that too many of these cases are submitted to operation, especially at the hands of inexperienced men, where better results could be obtained by non-operative methods. I admit that continued improvement in technic may cause me to change my opinion and practice, but I speak now rather from the point of view of a teacher of undergraduates. Greater care, personal effort, the proper use of extension, and constant watching of these cases, which we are apt to turn over to entirely inexperienced internes, will certainly keep out of our operative lists many of these cases. Here, particularly, the operator should understand that if after exposing the fragments he can reduce and maintain them in reduction by a proper dressing, he should not employ a plate or other mechanical device applied directly to the bone, as such is badly borne by the tibia on account of its thin covering. Non-union, especially where the position is bad, is a definite indication for operation, but the best operative results are obtained when the operation is done early; that is, as soon as it is evident that reduction cannot be accomplished. The open treatment of a Pott's fracture is rarely required except in old neglected cases, and here again the situation is not one suited to the use of a plate, the simpler methods of suture, nailing, etc., being better. The word "neglected" is used advisedly, because in the large majority of cases reduction can be accomplished and maintained with the expenditure of but a moderate amount of care. A certain proportion of Pott's fractures apparently heal in good position, and then the deformity recurs after the patient begins to bear his weight upon the part, and it is this type of case which is most frequently submitted to operation. The redevelopment of the deformity can easily be avoided by following a suggestion made by Mr. Robert Jones, of Liverpool, who, when the patient begins to walk, sees that the inner portion of the heel and sole of the shoe is slightly raised; this gives the ankle an outward turn and prevents stretching of the recently healed ligaments. If every patient upon leaving our wards is instructed to have his shoes altered in this way for six months, there will be fewer cases operated upon in the future than in the past.

Just as I have tried to show that continued traction will often result in reduction where spasmodic and intermittent traction will not, Crile has suggested that with deep anæsthesia, which causes complete muscular relaxation, our attempts at reduction will be far more successful than when we simply employ the anæsthetic to the point of relief from pain and the production of unconsciousness.

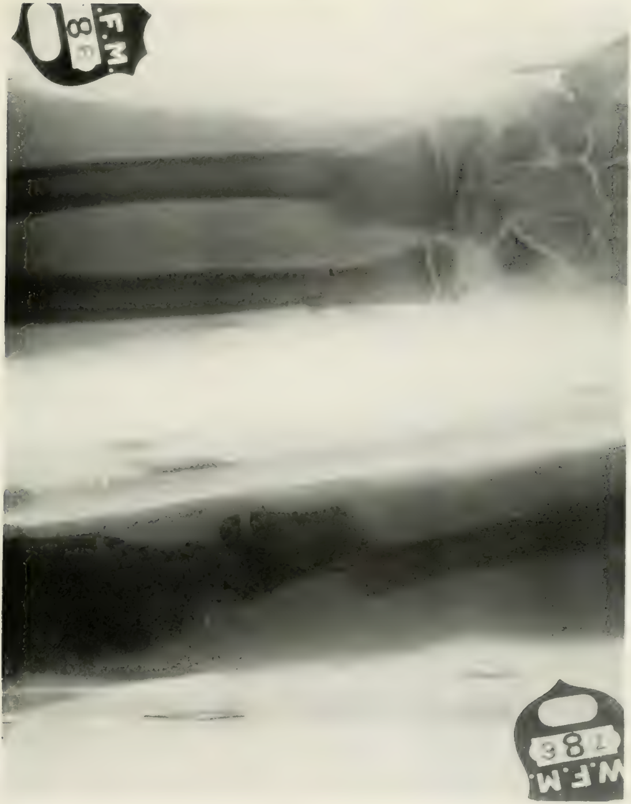
The contraindications to the operative treatment may lie in the fracture itself, in the patient's general condition, or in the operator and his surroundings. The contraindications to be found in the fracture itself are few, if, after careful and intelligent effort, reduction has not been accomplished and enough deformity exists to interfere with subsequent use or to distress the patient by its appearance. Local disease and infection of neighboring structures may preclude operation. I have at the present time a fracture of both bones of the forearm, in which there is an infected wound communicating with the ulna, which is in excellent position, and I am prevented from operating on the radius, the fragments of which are overlapped, because of the infection in its neighborhood.

The indications against operation to be found in the patient's general condition are those which would make one hesitate to perform any operation of election. All these, however, must be considered carefully, and they should often make us refrain from operation on a broken bone when we might operate for some other condition in which infection is less likely to occur, more readily overcome, or less disastrous in its results. A drain may, for instance, save another structure from infection, but we have learned that it has no place in the open treatment of simple fractures, rather inviting than preventing infection. My experience has taught me to look upon chronic alcoholism as a contraindication deserving of great attention, as is also an old syphilitic infection. The extremes of age may often constitute a contraindication, old age because the operation is more dangerous, and childhood because nature does so much in the subsequent growth of the bone to overcome the deformity resulting from fracture. The ultimate results secured in children, even where reduction was but partially obtained, were clearly shown in a series of pictures recently exhibited by Dr. Edward Martin before the Philadelphia Academy of Surgery. The accompanying picture (Fig. 3) of a spiral fracture of the femur in a five year old boy is one in which I expect to get a good functional result, even though I may fail in correcting the position. Such a fracture in an adult I should probably be obliged to subject to operation.

I also show plates of a bad fracture of the femur in an adult, when, in spite of the displacement of the fragments, an excellent functional result without apparent limp was obtained (Fig. 5).

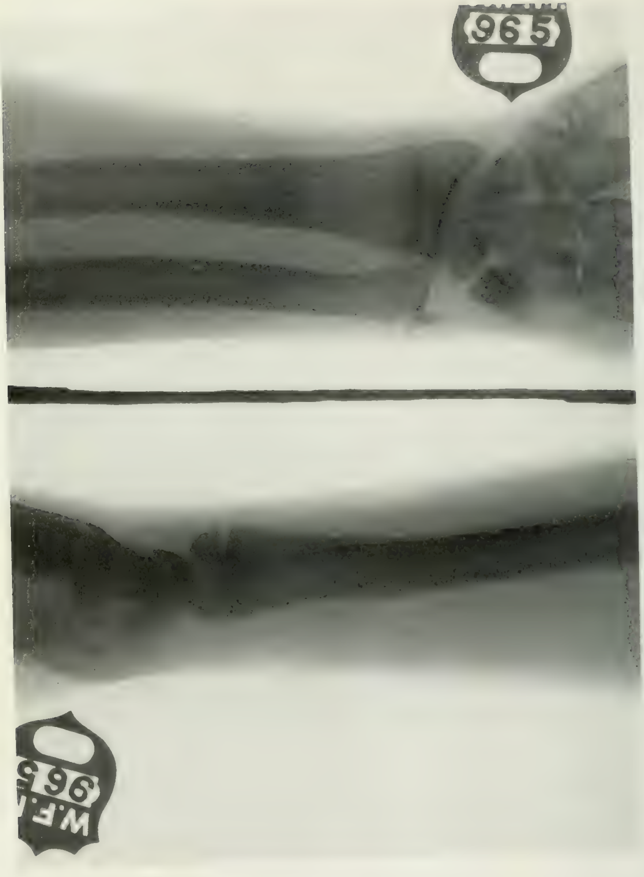
The contraindications to be found in the operator and his surroundings I would emphasize. There are probably but few surgeons who operate upon fractures with the same impunity and confidence that they perform other surgical operations of an apparently more serious nature. If this is true, it behooves us to know the reason. First, I take it, the

FIG. 1.



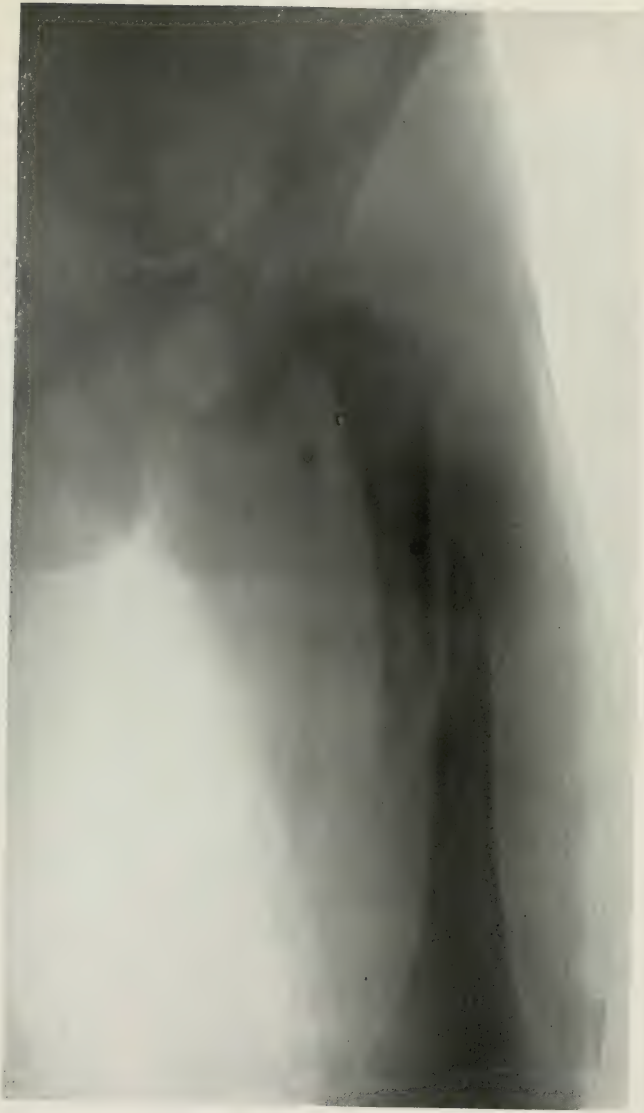
Fracture of both bones. Radius unreduced after two attempts under anæsthetic. Readily reduced after continuous traction of three days.

FIG. 2.



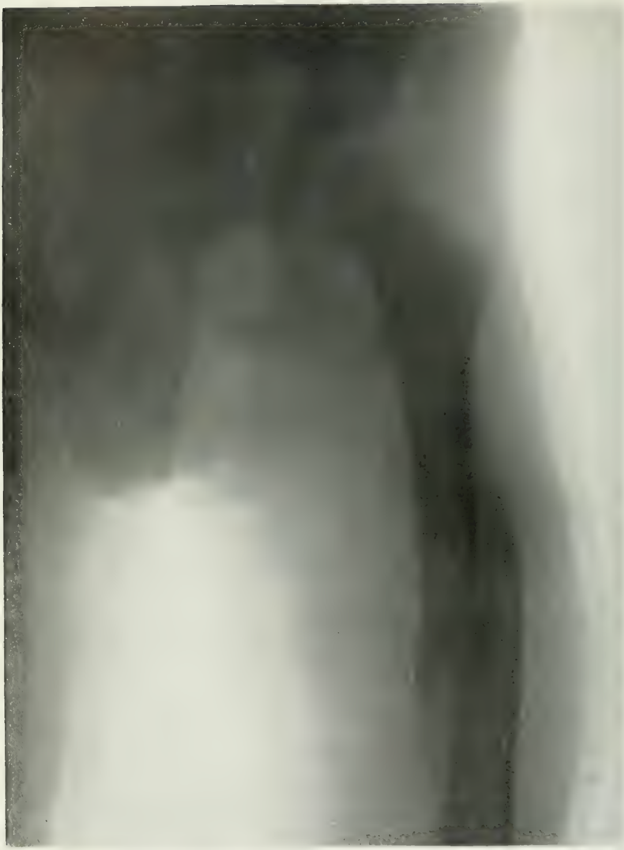
Same case as Fig. 1, eight months after injury.

Fig. 3.



Patient admitted to Pennsylvania Hospital November 27, 1911. Discharged January 18, 1912.

FIG. 4.

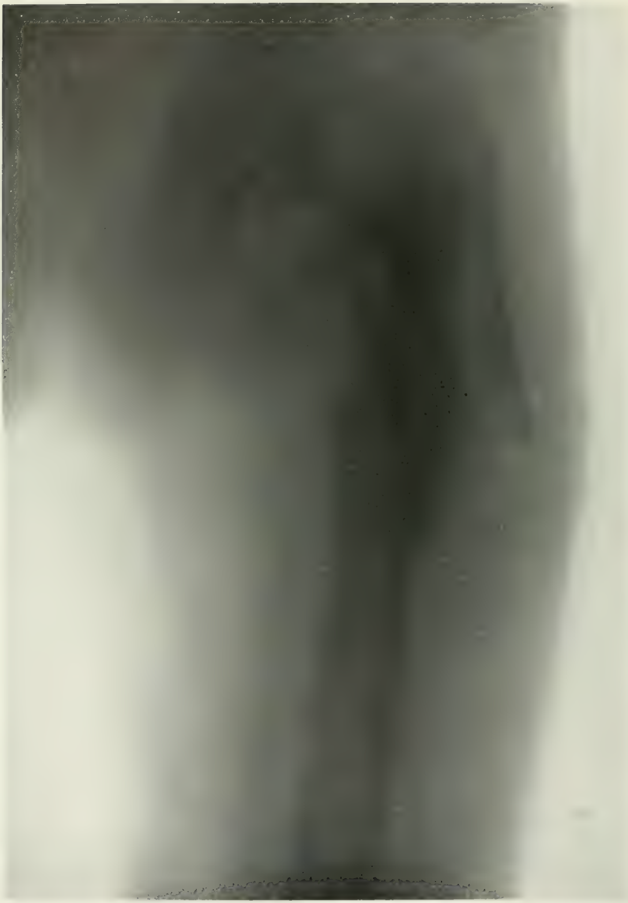


Same case as Fig. 3, taken ten weeks after injury. Excellent functional result.

Fig. 5.

Patient admitted to Pennsylvania Hospital December 17, 1911. Discharged February 8, 1912 on crutches.

Fig. 6.



Same case as Fig. 5, taken one week before discharge. Shortening 2.5 cm. Excellent functional result.

required mechanical skill is of a different sort from that necessary to the successful performance of most of the surgical operations, even of the most delicate character, and this is acquired only by careful study of the methods in vogue and by much experience; again, more care is necessary in this field than in any other to avoid infection, as we are dealing with a tissue, the medullary portion of the bone, whose resistance is slight; and still further, it may be said that failure of the operation often leaves the patient in a worse state, a greater cripple, than if no operation had been done. No one realizes these facts more fully than he who does the greatest amount of work in this field, and consequently when we are inclined to imitate the accomplishments of others, we should see that we are equipped at least to some extent as they are, and by equipment I do not mean the special instruments which are, however, most essential, but rather with ability to meet and deal with difficulties and with an aseptic habit and an environment which can be relied upon. If we could feel the same assurance regarding aseptic wound healing in fractures as we do in abdominal operations, half of the difficulties of this work would be overcome, and our results would be ten times better than they are at present. We are apt to minimize our percentage of infections in any type of operation, but I ask a careful study of our own cases and the perusal of any honest report by others, and we will then find that this important question of infection takes first rank when it comes to the open treatment of fractures. In a recent article on this subject, Lund, modestly describing himself as a beginner, reports eleven cases in which he has used the Lane plate, and in four of these he was obliged to remove the plate. If a man of his experience and ability finds this work difficult, it then becomes those with less experience and ability to move in this field of surgery with judgment and precaution.

In concluding this rather discursive paper, I would say that our aim should be to overcome the indications for open treatment by a perfection of our mechanical measures, and to obtain better results when we must operate by improving our operative technic.

THE TREATMENT OF SIMPLE FRACTURES: A STUDY OF SOME END RESULTS.*

BY JAMES MORLEY HITZROT, M.D.,
OF NEW YORK,
Associate Surgeon, New York Hospital; Assistant Surgeon, Bellevue Hospital.

THE presentation of this subject to the society has been prompted by the diverse opinions now existing regarding the question of open operation or conservative reduction in the treatment of recent simple fracture.

The whole question received its present impetus from the presentation of the subject of open operation in recent simple fracture by Mr. Lane.[1] While admiring Mr. Lane's able presentation of the purely operative side of the treatment of fractures, as well as his eminently successful results, it did not seem to the writer, from his experience, that one could safely subscribe to all of Mr. Lane's conclusions—and especially to that one which states that, "accurate or anything approaching accurate apposition of the displaced fragments in a fracture was obtained in only very rare cases by the various non-operative methods."

Bloodgood[2] quotes Lane as stating that the end results of the non-operative treatment for fractures are uniformly bad except in the hands of experts, and gives as his (Bloodgood's) opinion that more cases will be submitted to operation when publicity has forced better methods of treatment for fractures upon the profession.

Stimson[3] takes the opposite view from that elaborated by Lane, and sounds a warning of the dangers of the open method of treatment. Stimson bases his opinion upon the success obtained by him with non-operative methods.

Freeman,[4] in a discussion of the subject, takes what might be called a middle course between the above divergent views, and states, that by operating in well-selected cases better results can be obtained. He goes even further and gives a list of fractures with what he would consider the method of election in their treatment. The clavicle and transverse fractures of the long bones should be treated by conservative methods; avulsion of the tuberosities of the tibia, humerus, and os calcis; fractures of the surgical neck of the humerus with dislocation or rotation of the head of that bone; fractures of the humerus just above the elbow-joint; and spiral fractures of the long bones should be treated by open operation. Fractures of the olecranon and patella, he considers, occupy an intermediate position—some cases without separation being best treated by conservative measures while operation is indicated in all cases with separation of the fragments. At the elbow-joint every fracture should be operated upon when satisfactory replacement of the fragments, as shown by the X-ray, cannot be accomplished otherwise.

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* Read before the New York Surgical Society, Dec. 13, 1911.

Quoting Freeman further: "The success of operative intervention depends much upon the accessibility of the fracture, the danger varying directly with the amount of manipulation required; that faulty alignment and overlapping of the fragments do not mean disturbance of function, and, that in carefully selected cases it must not be forgotten there are two important drawbacks to operative intervention, namely, infection and delayed union."

If one can state these divergent views clearly Lane advocates nothing but operative treatment for simple fractures. Certainly one obtains such a belief from his papers.

Stimson favors the non-operative replacement of displaced fragments in all cases where this is possible, and limits operative interference to a very carefully selected class of cases in which operation offers a more suitable result, weighing carefully all the dangers coincident to that operation. In his book "Fractures and Dislocations" Stimson,[5] admits the propriety of operative interference when the fragment has been drawn into the muscle, and when the displacement in articular fractures, if uncorrected, may seriously interfere with the usefulness of the joint. As little relief is to be expected by a late operation, the operative treatment must be carried out while the injury is still recent, *i.e.,* within the first 24 hours, with this reservation, "but I am convinced it should be resorted to only after thorough study of the conditions and careful weighing of the probabilities."

In the reservation of Stimson and in the selection of Freeman, we find what may be considered the solution of some of the phases of this question. Extreme views pro or con rarely lead to a clear understanding of any subject, and such statements that only operative interference can produce the desired result cannot safely be subscribed to, nor can Bloodgood's belief that more cases will be submitted to operation when publicity has forced better methods of treatment of fractures upon the profession be allowed to pass unchallenged. Credit should be given these gentlemen for attracting the attention of the profession to the necessity of better and more careful treatment of fractures. That fractures should be handled by experienced individuals to procure the most favorable result should be axiomatic. Much of the present disability occurring in uncomplicated fractures is due to neglect or to a lack of experience upon the part of the medical attendant. No method, however perfect, will succeed if improperly carried out in any of its details, and the too ready assumption of ability to treat any and all fractures on the part of the inexperienced lays the profession as a whole open to sharp criticism emanating from Mr. Lane.

The crux of the entire question seems to be in what is to be most desired in the treatment of fractures, accurate anatomical reposition by open methods or approximate alignment as shown by the X-ray, with restoration of function to a degree sufficient for all practical purposes. If proper exact reposition anatomically is the only means toward the restoration of the above degree of function, and replacement can be obtained only by open operation, no surgeon of experience should hesitate to operate. But if satisfactory restoration of function, even in the face of what is not exact anatomical replacement, is possible by simpler, less dangerous methods, open operation should not be the method of election.

Deformity and disability are not always the result of improper replacement. Fractures of the lower end of the radius (Colles) may be completely replaced, yet crushing of the spongy lower end may so shorten the radius that the level of the two styloids is distinctly altered, the lower end of the ulna becomes prominent, the wrist-joint wider, and some radial deviation of the hand self-evident; yet function may be perfect except for very slight limitation of ulnar deflection. The same may be said of fractures involving the upper end of the humerus. Anatomical replacement, judged by radiographs, may seem perfect, yet, due to impaction, some shortening is inevitable and complete abduction may be impossible and external rotation distinctly interfered with. The same traumatism may also set up coincident joint changes, which do not appear until later or after the healing of the fracture and the return of function has been quite satisfactory to the individual as well as his surgical attendant.

The following case may illustrate this condition more clearly:

The patient, J. B., a man forty-three years old, was admitted to Bellevue Hospital, Dr. Gwyer's service, 1907, with a history of having fractured his right shoulder three years previously by a fall against the curb. The arm was set at the Presbyterian Hospital and put up in plaster away from the body. At the end of three months his shoulder was moving nicely and he was able to return to his work as a painter. The mobility of the joint steadily improved with use and he had no trouble except stiffness in the morning. About five months after the injury, that is eight weeks after recovery, he noticed that his right shoulder-joint was slightly swollen, and about the same time he had some pain, especially when he used the arm overhead. This pain has slowly but steadily increased up to the present, and function has become more limited, so that the arm is at present nearly useless. There are no other phenomena of any importance and no history of other joint inflammations, etc., of any bearing on the case, and he had no previous injury or disease of the right shoulder except the fracture. On examination the right shoulder was found swollen to twice the size of the opposite shoulder. The swelling was symmetrical, there was no skin inflammation, and no tenderness on palpation. Pain on active motion, passive motion was very painful if carried to any degree, no crepitation, joint loose, capsule tense and fluctuant. The X-ray showed no bony change, a perfect bone alignment, but a diffuse haziness about the head of the bone in the region of the distended capsule. On anterior incision, a villous arthritis with a clear straw-colored fluid was present in the joint. As much synovial membrane as was hypertrophied was excised. The bones and cartilage were normal. The pericapsular tissues were loosely closed, the wound drained subcutaneously from the lower angle and bound in a bulky dressing to the chest. The post-operative course was uneventful except for a thick, viscid synovial discharge for two weeks. The end result two years after operation was freedom from pain but a very restricted movement in all directions at the shoulder-joint in spite of massage, baking, passive motion by the Zander method, etc.

Personally the writer does not know what the gentleman could have done who obtained what the patient considered a good result nor is it clear how open operation could have in any way prevented the joint change.

Age must always play an important part in the result of any treatment for fracture. Extension fractures of the humerus (supracondylar) in children never give any disability and rarely any deformity, while the same lesions in the elderly result in marked disability even with perfect reduction without deformity.

Obviously it has not been possible to trace every case of any given type, as many have disappeared, but those which have been found are sufficient to give a fair idea of what the result in certain given types has been. Purposely many types of fractures have been omitted, such as fractures of the skull, of the bones of the face, of the pelvis, and fracture of the metacarpus and metatarsus and their phalanges, Colles's fracture, and cases of multiple injuries where the fracture or fractures had, in the original treatment, to be treated by the most expedient although often inefficient methods because of the patient's general condition—for example, crushing injuries of the chest and pelvis with fractures of both femora, etc.

The treatment has been the same in all cases of similar type, and the details will be given under the discussion of the type. One fact has become quite evident as the cases have been analyzed, viz., that early reduction before infiltration has occurred has given the best results. When the fracture has come under observation after the infiltration has occurred, it has often been impossible to bring about satisfactory reduction even under anæsthesia. In such cases extension by a sufficiently heavy weight, with constant supervision, was tried until replacement became easy or was obviously impossible by such means. That the period of time for such extension should not exceed one week from its inception became more and more evident, for displacements in over-riding, which could not be pulled down in that time, have not, in the writer's experience, been benefited by longer traction (this of course does not imply that traction should cease or did cease when the result was satisfactorily accomplished). When, at the end of a week, traction did not seem to be likely to accomplish the desired result, the patient was anæsthetized and reduction attempted under ether, and fixation apparatus applied while suitable traction was maintained. Very little benefit resulted from this procedure except in a few cases. The results of these procedures were controlled by measurements and suitable X-ray pictures, and when the latter did not show satisfactory results operation was carried out, after all the factors, such as age, cardiovascular, renal, and other intercurrent conditions, with the accessibility of the fracture, were given due consideration. In operating no foreign material was used when avoidable, chromicized gut was used wherever available, and Lane's plates only where other methods did not seem likely to avail.

Of the many types of extension those advocated by Bardenheuer,[6] the Hodgens splint and vertical suspension, were the most used.

Reduction under ether is always essential when there is no contraindication to that anæsthetic. In minor cases gas or gas and oxygen is preferable. In certain types, of which fractures of the shaft of the femur form the chief group, reduction under an anæsthetic often fails because of the inability to overcome the muscular pull, and in these the various forms of traction apparatus find their chief usefulness.

The author has used the following expedient for reduction under ether: Adhesive plaster is applied to the lower leg up to and above the knee as in Buck's extension. To the lower end of this is fastened a strong loop (three thicknesses of muslin), and this is put over the shoulders of an assistant, who, bracing his feet, leans backward, using the weight of his body for traction. A sheet folded lengthwise is passed under the patient and over the perineum and up over the body in the long axis of the body, and counter-traction made by the pull of a second assistant, who, holding both ends or passing the sheet around his body, braces his feet and leans back, using the weight of his body for counter-traction. This assures a steady pull without fatigue or the necessity of obtaining a fresh grip. (Dr. F. W. Murray, private communication, tells me that the above method of traction is one employed by Willelms of Ghent and was shown by Willelms at the recent International Surgical Congress at Brussels. The writer has been unable to find the published details, but claims no priority for a method which has doubtless been used by others.)

Of the many forms of retention apparatus, moulded plaster splints, made according to the method given by Stimson (*loc. cit.*) have proven the most satisfactory and have been used by the writer to the exclusion of all other forms of splint because of their strength, lightness, ease of removal and replacement.

Another too often neglected part of the proper treatment of fractures is the so-called after-treatment. Massage should be begun as soon as the callus is solid enough to prevent displacement and as soon as pain on handling has disappeared. Baking should be begun as early as the beginning of the second week. The time for removing the fixation apparatus is one of the niceties in the after-treatment, and no time can be specifically stated. In general, the earlier active and passive motion is allowed, within the limits of pain, the better the result. Obviously no weight should be borne by a bone or bones which are not yet solid without additional external support.

Hydrotherapy and electricity for the preservation of muscle tone and activity should never be neglected.

An X-ray picture is, in the large majority of cases, in no wise essential for diagnosis of fracture, but is of invaluable aid as an adjunct in determining the result of a given method of reduction and retention, and should never be omitted. Since early reduction before infiltration of the soft parts has occurred has given the more favorable results, any lengthy delay for an X-ray picture should be avoided, reduction done, and the ray then requisitioned to control the result and this later act should be carried out without any delay. Too often such control pictures, measurements, etc., are left until only operation remains as a means of approximation of the fragments, although the picture for diagnosis is never overlooked.

Where operation is necessary, so many successful expedients have been proposed that the selection of any given type of fixation must, of necessity, be governed by the fracture in question. The writer uses no fixation apparatus when the two fragments can be held in alignment without it (manipulation is done with the bones in view). If possible only strong chromicized catgut is used, and where it seems likely to fail the method advised by Lane seems the most expedient. Intramedullary splinting and fixation by screws with outside plates are doubtless very successful in the hands of the originators, but the writer has found the above quite sufficient to meet the various conditions which have come under his care.

That the cases here have been selected may be criticized, but, admitting the criticism, the cases were chosen not because of their types, nor because the result may or may not have been favorable, but simply because the individuals in question had a more fixed and more easily found domicile and were not the birds of passage with the municipal lodging house or Mill's Hotel addresses. Any one who has tried to trace the latter class of individuals, especially in New York City, will appreciate the reason for such selection. Some cases by virtue of suits at law to obtain recompense for their injuries from employers, etc., have kept the writer from losing track of them.

Clavicle.—Twenty-seven cases of fractured clavicle were traced. Nine cases were in children 2, 3 (3 cases), 4, 5 (2 cases), 6, 7 years of age; 4 cases were in women (17 to 27 years of age); 14 cases in men (16 to 37 years of age). Type of fracture: In 4 cases the fracture was transverse, in the remaining 23 it was oblique. Seat of involvement: The middle third of the clavicle in all cases. Type of deformity: Upward and forward displacement of the outer end of the inner fragment, downward and inward displacement of the inner end of the outer fragment with over-riding of the fractured ends. Method of treatment: reduction was accomplished by placing the patient prone on the back with a sand bag between the shoulder-blades and a sand bag under the sacrum. In this position the ordinary Sayre dressing was applied and so adjusted after patient assumed the erect position that it kept the fragments as nearly as possible in the position obtained with the patient recumbent as described. After appropriate axillary and skin padding, a Velpeau bandage was applied and the above dressing kept on the patient for three weeks. Massage was then begun and the arm carried in a sling for one week longer.

Result: In all the cases there was slight deformity at the site of the fracture (*i.e.,* thickening with a visible angulation as compared with the opposite side and shortening of the clavicle of from 0.3 cm. to 0.5 cm. The shortening was less marked in the children and most marked in the men, and the same statement applies to the visible and palpable deformity. There was no disturbance of function in the arm movements of any of the patients. One woman suffered from rheumatism in the shoulder when the weather threatened rain, but localized the pain over the shoulder in general rather than over the site of the injury in particular.

HUMERUS.—*Fractures of the Surgical Neck* (141 Cases).—Sixteen cases of old fractures in this region sought relief from disability, but as the treatment was not begun at a time likely to give any reliable result, they are not included in the above figures. Seven other cases which died of intercurrent disease within three months after the injury and three cases reported by relatives as perfectly well with useful arms have likewise been excluded.

Of these 141 cases for analysis 2 were in children (7 to 9 years of age); 38 were in women (49 to 67 years of age); and 101 in men (45 to 79 years of age). Sixty-nine cases were fractures through the tuberosities, 70 were below the trochanter, 2 began well below the trochanter and ran upward through the greater tuberosity, separating it as a separate fragment from the head and the upper end of the shaft. Of the 141 cases, 65 had displacement of the upper end of the lower fragment into the axilla, 67 were more or less impacted with penetration of the upper end of the lower fragment into the upper with crushing of the upper fragment (of these 63 had little gross displacement); 7 were clear-cut transverse fractures with varying amounts of internal displacement of the lower fragment, from that completely under the coracoid to practically none whatsoever, and the two, mentioned above, were irregular in type.

Type of deformity: Those cases with marked axillary displacement showed an obtuse angulation in the limb about halfway between the acromion and deltoid insertion. The impacted cases and other types had swelling about the deltoid region and shoulder.

Treatment: With the forearm flexed and held in a sling a modified Stromeyer cushion was placed in the axilla for abduction, and adhesive plaster strips were applied from the level of the deltoid insertion to the elbow, with the ends extending below the level of the elbow for about six inches. To these ends a weight of from five to ten pounds was attached and allowed to hang for one hour. If reduction was then satisfactory, moulded plaster splints were applied. (The posterior splint should begin at the base of the neck and pass down the arm to the wrist on its posterior aspect, leaving the latter joint free. The anterior splint should begin at the vertebral column about the level of the superior angle of the posterior border of the scapula, pass forward across the shoulder cap of the posterior splint and down the arm to the wrist.) The weight and cushion should be kept in place during the application of the splints, and the width of the cushion should be sufficient to bring the bone in proper alignment. An X-ray picture was then taken. In cases where reduction was not satisfactorily accomplished in that time, the arm was bound to the chest and traction continued over night and the splints applied on the following day. One case, E. D., age nine, was operated upon. The fracture was eight days old and reduction under anæsthesia impossible. Through an anterior incision the seat of fracture was exposed and the line of fracture found to be through the shaft just below the epiphysis. The upper end of the lower fragment was mobilized and jammed into the cancellous lower end of the upper fragment, where it remained without any tendency to become displaced. Wound closed without drainage (splints as above, X-ray photographs, Figs. 2 and 3, from Dr. Hartley's service, New York Hospital, 1908).

After-treatment: Massage was begun at the end of ten days and carried on every second day. At first the splints were kept on for five weeks, but as the writer gained confidence it was possible to remove the splints at the end of the third week. Passive motion was begun as soon as the swelling subsided, and active motion when the splints were removed, and the free use of the arm allowed at the end of the fifth week. Electricity (galvanic and faradic) begun at the end of the fourth week in the last 50 cases for the nutrition of the deltoid. (*Vide* the results.)

Results: The two children, one operative and one non-operative (Fig. 1), had perfect results with no limitation of motion. Both showed one-sixteenth of an inch shortening (measured from the acromion to the head of radius).

In the remaining 139 cases hyperabduction of 5 per cent. was lost in all except two cases. In one of these cases the arm could only be abducted about ten degrees beyond the horizontal (woman with an impacted fracture with no displacement); in the second case (also an impacted fracture with no displacement), hyperabduction was possible to half the distance of that on the normal side. In testing the degree of hyperabduction, the vertebral border of the scapula was marked with the arms at the side and, during the act of hyperabduction, the scapular border moved one-eighth of an inch further from the midline on the affected side than on the normal side, showing that the extra movement beyond a certain point was accomplished by an increase in the movements of the scapula.

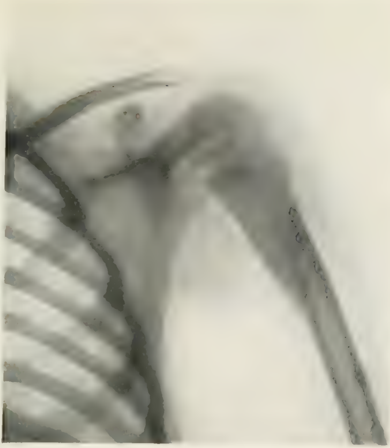
External rotation of from 5 to 10 per cent. less than on the normal side was present in all cases.

In both external rotation and hyperabduction, the relative loss in motion was much less in those 50 cases in which the splints were removed earlier, active motion begun in the fourth week, and electrical stimulation applied to the muscles.

Pain was present in twenty-two cases, especially during barometric changes; 67 cases had some stiffness in the shoulder on arising, which disappeared when the arm was used.

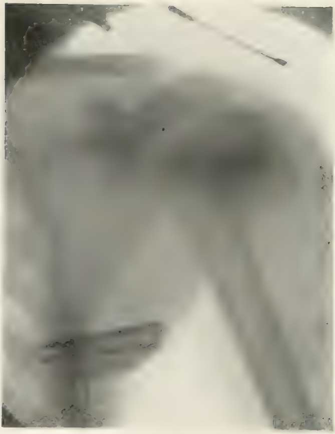
CASE I.—*Fracture at the Neck with Dislocation of the Head* (4 Cases).—John A., age forty-two, Bellevue Hospital, Dr. Gwyer's service, 1907. Fracture of the surgical neck with subcoracoid dislocation of the head of the right humerus (X-ray

FIG. 1.



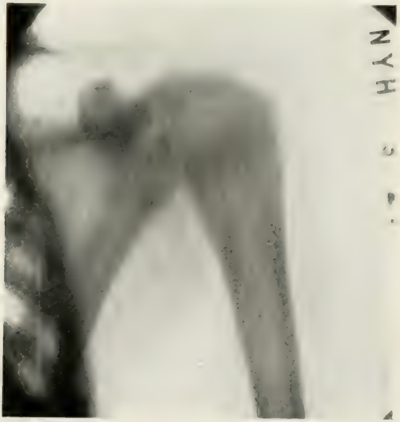
Result in fracture of the surgical neck of the humerus.

FIG. 2.



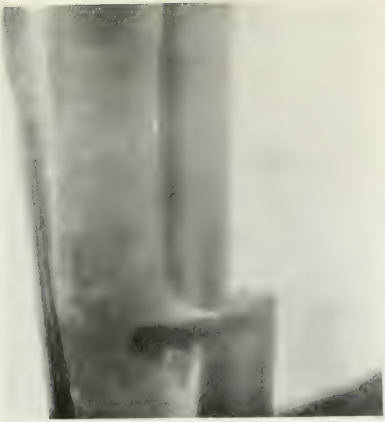
Fracture of the surgical neck of the humerus, before operation. (See Fig. 3.)

FIG. 3.



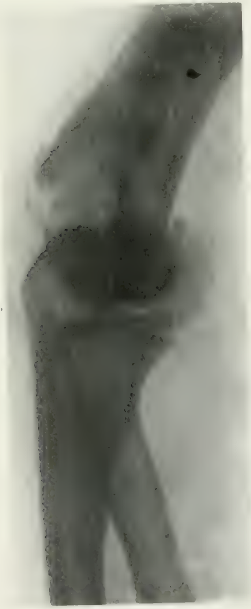
Fracture of the surgical neck of the humerus, after operation. (See Fig. 2.)

FIG. 4.



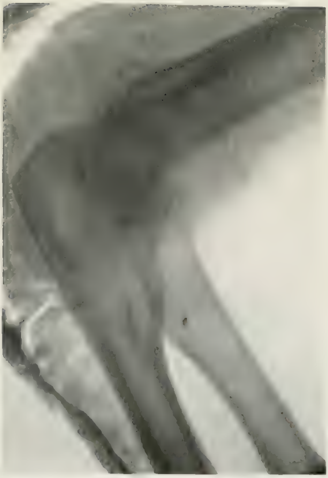
Fragment interfering with reduction; operation indicated. (From the service of Dr. F. W. Murray.)

FIG. 5.



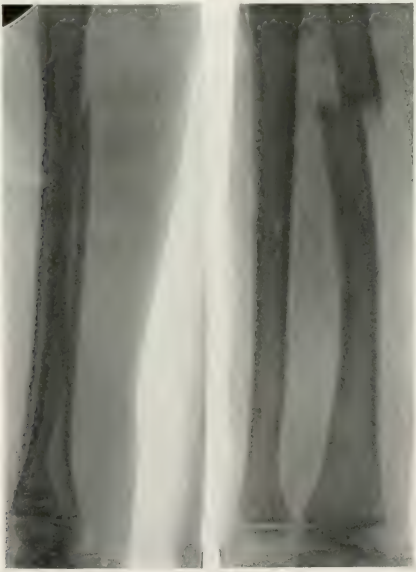
Diacondylar fracture of the lower end of the humerus in an adult, before reduction.

FIG. 6.



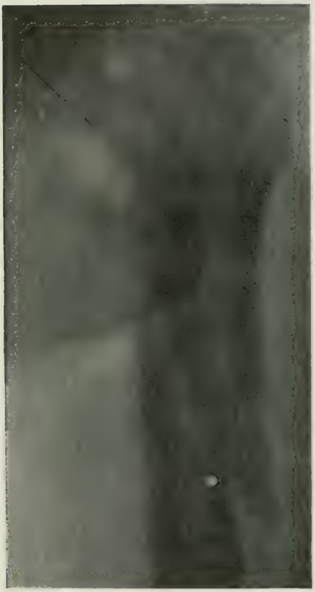
Diacondylar fracture of the lower end of the humerus in an adult, after reduction. (See Fig. 5.)

FIG. 7.



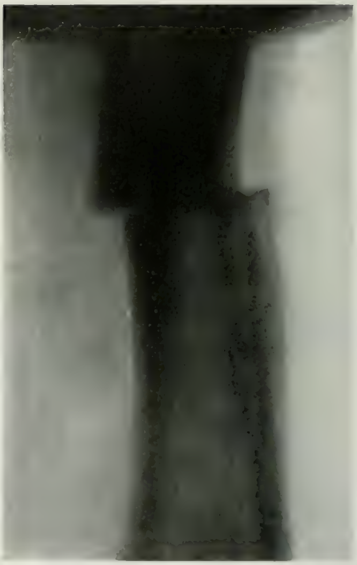
Position of fragments after efforts at reduction of a fracture of the bones of the forearm in their upper third.

Fig. 8.



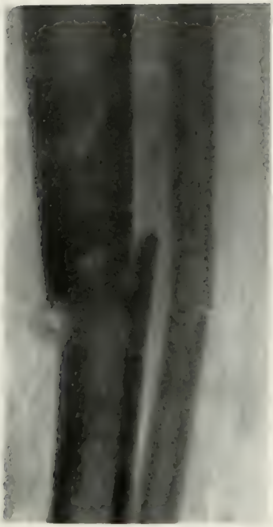
Result obtained by traction in a subtrochanteric fracture of the femur.

Fig. 9.



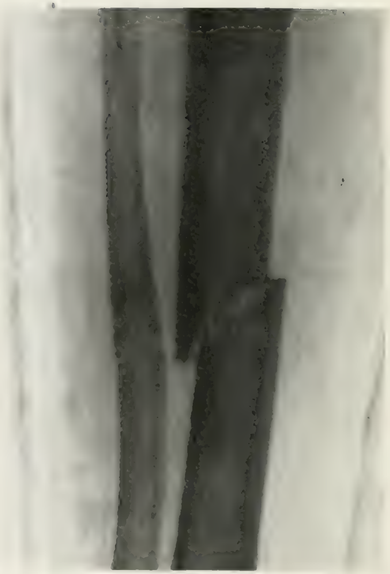
Result obtained by method described in text for reduction of a fracture of the femur. (Case of John G.)

FIG. 10.



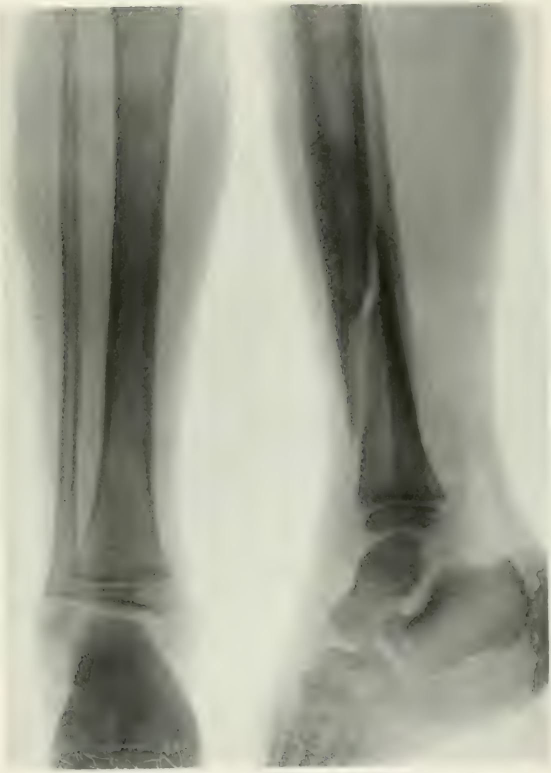
Result of reduction in a fracture of the leg.

FIG. 11.



Result of reduction in a fracture of the leg.

FIGS. 12 and 13



Result of reduction in a spiral fracture of the tibia and an oblique fracture of the fibula in a child.

diagnosis). Operation refused. Patient was a Christian Scientist. Sixteen months after the injury shoulder was stiff, with no movement in any direction. There was marked weakness of all the muscles of the hand and forearm, with atrophy of the entire arm. The patient was satisfied with the result.

CASE II.—Harriet DeC., age forty, Bellevue Hospital, Dr. Woolsey's service, 1910. *Fracture of the anatomical neck of the left humerus with dislocation of the head into the axilla* (X-ray diagnosis). Removal of the head through anterior incision nine days after injury. Result: Limitation of motion at the shoulder-joint. Abduction to 75 degrees. Very little external rotation. The patient could just get her hand to the top of the occiput. There was no pain, the deltoid was atrophied, but there was no skin anæsthesia over the deltoid (three months after operation).

CASE III.—D. C. L., age forty-nine, Bellevue Hospital, Dr. Rogers's service, June, 1911. *Fracture of the anatomical neck of the humerus (left) with subcoracoid dislocation of the head. Splintering of the shaft of the humerus on its inner side.* Operation 16 days after injury. Anterior incision, attempt to replace head failed, head excised, moulded splints with the arm in abduction. Massage, passive movements, etc., at the end of the third week. Result: Six months after operation abduction to beyond a right angle, very slight external rotation. The patient is able to reach the posterior collar button with ease.

CASE IV.—Mrs. B., age sixty-three (reported by Dr. A. B. Johnson, ANNALS OF SURGERY, vol. li, 1910, p. 267). *Excision of the head for fracture of the anatomical neck of the left humerus with displacement of the head into the axilla.* Result: Nine months after injury, abduction to a right angle; very little external rotation; some pain after use of the shoulder.

Fracture of the Shaft of the Humerus.—Seventeen cases, all men ranging in age from 17 to 47 years.

Type of fracture: 10 cases were transverse or nearly so; 6 cases were oblique (with comminution in 1 case; 1 case was a spiral fracture.

Location: All were situated between the deltoid insertion and the supracondylar ridge, and gave no characteristic deformity other than over-riding and shortening of from one-half to two inches.

Treatment: Modified Stromeyer pad in axilla, extension by adhesive plaster and weight, and moulded plaster splints (see fractures of the surgical neck for detail). Massage was begun on the fourteenth day and the splints removed at the end of the fifth or sixth week, depending upon the solidity of the callus. In one case solid union did not take place until the tenth week. One case fell and refractured the arm through the callus in the tenth week, and the repair of this second fracture was not complete for fourteen weeks.

Results: In the ten transverse fractures function was perfect and no shortening was present. One case had slight angular deformity at the line of fracture due to insufficient abduction. The spiral fracture and two of the oblique cases showed one-eighth of an inch shortening. The other four oblique cases showed no shortening, a perfect alignment of the arm. In all these cases function was perfect. In the case in which refracture occurred, atrophy of the involved arm was quite marked. The difference in circumference, three inches above the olecranon, was two inches less on the affected side. This atrophy may undoubtedly be explained by the long period of disuse (19 weeks).

Fractures of the Lower End of the Humerus.—One hundred and six cases were in children from 1 to 10 years of age. Of these 52 involved the external condyle; 54 cases were supracondylar fractures; 34 cases were in adults from 20 to 74 years of age.

Fifty-one cases of fracture of the external condyle in children were all treated by hyperflexion with a moulded posterior splint or adhesive plaster and bandage for two weeks, when all fixation apparatus was removed and massage begun. One case (Mamie C., Bellevue Hospital, Dr. Woolsey's service, 1908) had rotation of the fractured fragment which could not be corrected and the broken fragment was removed by open operation. All had perfect return of function with no appreciable deformity. The 54 cases of supracondylar fracture in children were reduced under anæsthesia, and moulded plaster splints applied with the arm flexed to a right angle or slightly beyond it. To prevent the gun-stock deformity the writer has found a moulded posterior splint from the shoulder to the wrist with a U-shaped splint about the elbow, with that arm of the U over the inner side of the forearm placed a little more upward than the posterior limb of the splint, to be the most satisfactory.

Two of the cases had musculospiral paralysis and were operated upon, one four and one five weeks after the injury. In one of the cases, the musculospiral nerve was torn completely apart just at the level of the fracture (Johnny C., 1910, House of Relief, Dr. Hartley's service. The ordinary end-to-end anastomosis was done, and nerve function as evidenced by the return of extension became complete in twenty weeks. In the second case (William S., New York Hospital, 1908, Dr. Hartley's service), the nerve was found flattened out over the line of the fracture, but its continuity was not severed. The nerve was freed from the scar tissue surrounding it. Function did not become marked until seven months had passed, and nine months after the injury was not as satisfactory as that in the first mentioned case.

Function at the elbow-joint was perfect in all cases. Fifty cases had no perceptible deformity, and arm tracings showed the same carrying angle for the two arms. One case had almost a straight arm in the extended position, and three cases had a perceptible change in the tracings with a diminution of the carrying angle on the affected side.

Of the 34 adult cases, 12 involved the external condyle; 11 were uncomplicated. In one there was a fracture of the head of the radius without displacement of the fragment. All were treated by flexion with a posterior plaster splint, but the degree of hyperflexion possible in children could not be obtained here. There was no deformity in any of the cases. Function was excellent but not perfect, extension was less complete by about five degrees and flexion by about ten degrees, the flexion being most limited in that case with concurrent injury to the head of the radius.

Six cases were fractures of the internal condyle treated by flexion and plaster splints after reduction under ether. The function was excellent in all cases, perfect in one. Extension and flexion were limited by from five to ten degrees in five of the cases. Widening of the joint with thickening of the lower end of the humerus was present in all cases.

Four were T- or Y-shaped fractures. Reduction was done under an anæsthetic and moulded splints of the type described in the treatment of fractures of the surgical neck were applied with the forearm flexed to, or slightly beyond, a right angle. Reduction was not satisfactory on the first attempt in any of the cases and had to be tried four times in one of the cases before the fragments were brought into suitable apposition. Deformity was present in all cases, *i.e.*, widening of the elbow-joint with distinct anteroposterior thickening of the humerus and one-eighth of an inch shortening. Function: Flexion 20 degrees beyond a right angle and extension to 150 degrees in all cases. Pronation and supination of the forearm were perfect. One case had some stiffness in the joint in the morning, which disappeared as the arm was used. All do hard manual labor but find the injured arm sufficiently useful for all purposes.

In all of the above types baking and massage were begun on the tenth to the fourteenth day and active and passive motion, within the limits of pain, at the end of the third week, and all fixation apparatus was removed at the end of the fourth week. Full use of the arm was permitted in the tenth week.

One case (Henry W., Figs. 5 and 6, service of Dr. F. W. Murray, House of Relief, May, 1911) was a supracondylar (diacondylar) fracture in an old man seventy-nine years of age, and resembled that lesion as it occurs in children except that the articular fragment was displaced forward and inward. Under morphine ¼ gr. and gas and oxygen anæsthesia, reduction was done and a posterior moulded splint from the shoulder to the wrist was applied, with the arm flexed to a right angle. Flexion beyond this point caused the lower fragment to slip slightly backward and inward. Massage and baking were begun at the end of the first week, passive motion on the sixteenth day, and all fixation apparatus removed on the twenty-fifth day. No deformity was present, but after 6 months of baking and massage flexion was limited to about a right angle (occasionally the patient could bring the forearm beyond that point with the other arm). Extension was limited to 130 degrees and supination was just half that of the normal arm. The patient had "rheumatism" in the joint and very marked stiffness which took several hours to disappear. He had arthritis deformans in both hands, wrists, feet, and a very high degree of arteriosclerosis. The degree of functional disability, the pain and stiffness in this case, are worthy of comparison with the result of the same lesion in children, yet the X-ray showed perfect anatomical reposition of the fracture!

Eleven cases may be classified as extension fractures of the lower end of the humeral shaft. The line of fracture began just about the level of the epicondyles and ran upward and backward obliquely to varying levels. All were in men and all presented the characteristic deformity of this type.

Seven were reduced under anæsthetic, four by traction by adhesive plaster and weight and abduction (Stromeyer pad; see method for surgical neck and shaft). After reduction the same moulded plaster splints were applied as in fracture of the surgical neck of the humerus with flexion of the forearm to or just a trifle beyond a right angle. In none of the cases was absolutely perfect end-to-end alignment obtained, the lower end of the upper fragment over-riding and projecting beyond the line of fracture of the lower fragment to a very slight degree. In all cases massage was begun at the end of the second week. Solidity occurred in all but one case by the end of the sixth week. The latter became solid in the ninth week. There was no visible deformity in any of the cases, one-sixteenth to one-quarter of an inch shortening (the majority being one-eighth of an inch short). Function was perfect in every case.

RADIUS.—There were 29 cases of fracture of the head and neck of the radius. Of these 19 involved the head and 10 the neck.

In 15 cases of *fracture of the head* there was but little displacement of the fragments. In four cases the fragments were displaced anteriorly.

The disability was rather characteristic in all types. The arm was held in flexion midway between pronation and supination and both the latter movements were impossible. Pain was markedly increased by abducting the arm and pressing over the head of the radius, and especially so, if pronation and supination were attempted in the above position with the above pressure.

Treatment: In the fifteen cases without displacement the arm was supported by a posterior splint, baking begun on or before the third day, and massage before the second baking, *i.e.*, on the fifth day. Movements in flexion and extension were begun as soon as the swelling subsided, usually about the tenth day. Pronation and supination were begun about the fifteenth day. Result: Flexion and extension were complete in all the cases. In two cases (chipping off of the radial side of the head) pronation and supination were so slightly altered as to be classed as perfect. In eleven cases pronation and supination were half of that on the normal side. In two of the same type as the first two mentioned cases, but with the line of fracture beginning well to the ulnar side of the articular surface of the head and extending outward through the head, supination was one-quarter and pronation one-half normal. Both the latter cases have some pain during pronation and supination.

In the four cases with displacement of the fragments the X-ray was necessary for diagnosis of the displacement. In two the head was broken into three fragments, two of which were displaced anteriorly while one fragment remained in position. In this type the entire head was removed by cutting through the neck about one-half inch below the articular surface of the head and removing the head.

In the remaining two cases the head was broken in one place only and the fragment which was radially placed was displaced outward and forward, and in this type the fragment only was removed.

The after-treatment was similar in other respects to that pursued in the fractures without displacement.

Result: The resulting motion was better in those cases in which the head was removed and better in that case in which the most bone was removed (*i.e.*, the neck cut through at the lowest possible level). In the last mentioned case supination was present to seven-eighths the normal and pronation was complete. In the other case of complete removal, supination was two-thirds normal and pronation seven-eighths normal.

In the two cases of partial removal of the head, supination was one-half normal, pronation two-thirds normal, and pain was present during either movement in one of the cases for nearly a year.

The ten cases of fracture of the neck of the radius were all transverse in type and involved that portion of the shaft about one-half inch below the head. The X-ray was used to confirm the location of the fracture, and in none of the cases was there any marked displacement.

Treatment: With the arm in the mid-position between pronation and supination a U-shaped plaster splint (see fractures of both bones of forearm for details) was applied and left on for from 3 to 5 weeks. Massage was begun on the tenth day and passive motion and rotation at the end of the third week.

Result: Pronation was complete in two cases and in these two supination was also nearly complete. In the other eight cases, pronation was two-thirds normal and supination five-eighths normal.

ULNA.—*Olecranon,* 47 cases, all in males ranging in age from

18 to 49. The line of fracture was transverse in 23 cases and oblique in 24 cases.

In 26 cases there was no displacement of the fragment and no deformity other than the swelling. Where separation between the fragments existed, distinct angulation at the line of fracture or definite depression between the fragments gave a fairly characteristic deformity. In both types the X-ray was used to determine the method of treatment, unless such gross displacement was present as to render that procedure superfluous.

Treatment: 26 cases were treated in the extended position with a posterior moulded splint; 21 cases with more or less displacement were operated upon at the New York Hospital by members of the attending staff. Chromic catgut was used to approximate the fragments by drilling the bone in 11 cases, by suture of the torn fascial expansion and periosteum in 10 cases. Massage was begun at the end of the second week in both varieties, and slight movement in flexion in the third week, and full motion permitted in from 9 to 10 weeks. Baking was used in 12 cases.

Results: Function was perfect in 40 cases. In 6 cases, 4 operative and 2 non-operative, there was a perceptible loss in flexion and in one of the non-operative cases this loss of flexion was 10 degrees. Two cases which were operated upon show separation of the fragments, one four months and the other six years after operation, *i.e.*, fibrous union. There is no movement between the fragments, and function is perfect in both cases. In one case the bone was drilled, in the other suture of the fascia alone was done.

Fractures of the Shaft of the Radius and Ulna (91 Cases).—Sixty-one cases were in children from 1 to 15 years of age and 30 were in adults from 17 to 47 years of age. Of the cases in children, 21 were subperiosteal fractures of both bones, 12 were subperiosteal in the ulna with complete fracture of the radius, and 28 were complete fractures of both bones.

In the 58 cases of complete fracture of both bones (28 children and 30 adults), the line of fracture was transverse in 50 cases and oblique in 8.

The middle third of the bones was the region most frequently involved, and the radius was fractured at a slightly higher level than the ulna in all but four of the cases.

Deformity: The usual angulation, which was most marked in the complete fractures of both bones.

Treatment: Ether anæsthesia, correction of the angulation in the subperiosteal type; in the other types approximation of the ulnar fragments, then traction in ulnar abduction. This traction should be made by two assistants so that the surgeon can manipulate the radial fragments into proper alignment. When the necessary approximation is obtained the arm is straightened, the traction being maintained, and the U-shaped moulded plaster splint[7] applied, with the arm in the mid-position. The fingers must always be left free.

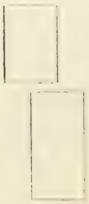
In the transverse fractures one attempt to bring the radius in approximate apposition sufficed in all but one case. In the oblique variety four separate attempts were needed in two cases. The one unsuccessful reduction in the transverse type was ten days old when first observed and could not be reduced. Non-union at the end of eight weeks forced the patient to consent to open operation. The ends of both bones were freshened, sutured with chromic gut, and the U splint applied.

Massage was begun in the second week and the splints were removed as soon as the bones were solid (4½ to 9 weeks, average 6 weeks). In the operative case, solid union did not occur until the fourteenth week.

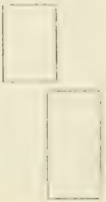
Results: In the 33 subperiosteal fractures function was perfect in all cases; 7 cases showed slight bowing of the forearm, as determined by outline drawings with the arm in the mid-position between extension and flexion.

In the cases of complete fracture, function was perfect in all but two cases. In these supination was five-eighths normal and pronation almost complete. Complete perfect end-to-end apposition of the radial fragments was not obtained in any of the cases.

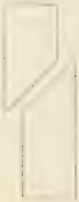
The apposition was as follows (X-ray tracings, schematic):



..41 cases



..10 cases



..7 oblique cases

In the seven oblique cases, there was shortening of the affected forearm of one-sixteenth to one-eighth of an inch and slight bowing on the radial side of the arm. Union in these cases took from two to four weeks longer to become solid than in the transverse type, but occurred in all seven. The function was good in the one operative case, supination was six-eighths normal and pronation almost complete. The arm was one-eighth inch short.

THE CARPAL SCAPHOID.—Fourteen cases were followed; in 7 there was no displacement of the fragments; in 3 the proximal fragment was displaced; and in 4 there was coincident dislocation of the semilunar with displacement of the proximal scaphoid fragment.

The 7 uncomplicated cases were treated by a moulded anterior splint with the hand in slight radial deflection and extension, and the fingers left free. Baking was begun in the first week, massage in the second week, and full movement in the sixth week. Hyperextension was limited in all cases, flexion in one only. In the latter case pain on motion was present during heavy lifting and after long use.

In the three cases with displacement of the proximal fragment, it was removed through a dorsal incision and treated as in the above type. Extension was limited to two-thirds normal and flexion to seven-eighths normal. Ulnar deflection was less on the affected side.

In the four cases with dislocation of the semilunar and displacement of the proximal fragment of the scaphoid, the semilunar and the displaced scaphoid fragment were removed in three cases. In the fourth case the scaphoid fragment was removed and the semilunar replaced. At least it seemed to be reduced at the operation, but the radiograph showed the semilunar still displaced, although not to the same extent as before operation. The result at the end of nine weeks was a stiff wrist. A second operation was refused, and at the end of six months the wrist was still stiff and the patient disappeared. In the first three mentioned cases the result was fair in two. There was some radial deviation of the wrist, the lower end of the ulna was more prominent, flexion and extension were one-half normal. There was some stiffness in the morning and, as explained by one patient, a sense of insecurity after the wrist was used for a time and when heavy lifting was done. No pain existed. One case, the most satisfactory, has already been shown to the society (ANNALS OF

Surg., 1910, vol. lii, p. 261) and in that case there was practically no limitation of motion, and pain only in dorsal extension when lifting unusually heavy weights.

The Femur.—In selecting the cases for observation, fractures of the head, of the neck, and fractures of the neck involving the trochanters have been excluded as those types have been investigated and the end results reported by Whitman,[8] Walker,[9] Forbes,[10] Flint,[11] and others.

In choosing the cases for observation, the writer has attempted to select cases with a sufficient variety of bone lesions to show the value of any given type of treatment as determined from the end result.

Fifty-three cases have been followed; 2 involved the shaft below the trochanters, 40 involved the shaft, chiefly in the middle third, and 11 were fractures which involved the condyles or the shaft immediately above the condyles.

Two cases of *fracture immediately below the trochanters* (Stafford, New York Hospital, Levinthal, Bellevue Hospital), men, past forty. One was a transverse fracture and the other an oblique fracture about six inches below the posterior lip of the greater trochanter. In both cases the upper fragment was flexed and abducted and there was two inches shortening (measured from the tip of the greater trochanter to the internal malleolus). Both were treated by suspension, traction, and abduction in the Hodgins splint for five weeks, and then by a plaster spica for five weeks longer, at which time union was sufficiently solid to permit the wearing of a long side splint of moulded plaster. Massage was practised thrice weekly after the tenth week and the knee and hip moved during the massage. Weight-bearing without support was permitted in the fifteenth week and full use of the leg as soon as the patient gained confidence enough to walk without support. The time element for this must naturally vary widely. It did in the above two cases. In the oblique case the patient walked alone and unsupported at the end of the seventeenth week. In the transverse case, although muscular power, bony solidity, and freedom of motion in the hip, knee, and ankle were present, the man did not gain enough confidence to walk alone for over two months. He did walk for long distances holding on to the arm of an attendant.

Result at the end of six months: Perfect function in both cases with ¼ inch shortening. The case with the transverse fracture walked with a slight limp, which disappeared when the heel of his shoe was raised ⅛ of an inch.

Fractures of the Middle Third of the Femur (40 Cases).—In speaking of this region it should be described as the middle two-fourths, as the line of fracture in some of the cases extended either above or below the actual mid-third, although the majority involved that region.

Twenty cases in children from 1 to 8 years of age have been followed. Of these one case, infant 13 months old, had an incomplete fracture of the middle third, one case had a spiral fracture beginning in the lower third and extending upward, the remaining cases were transverse.

The deformity in all except the incomplete fracture was overriding of the fragments with from one to three inches shortening.

Treatment: Under ether eleven cases were reduced by the traction method described above or a modification of it, and the fragments manipulated until the ends of the bone were made to engage. The leg was then straightened and a plaster spica applied, care being taken to have the anterior superior spine, the mid-patella, and the middle of the ankle in the same alignment as on the normal side. Reduction by this method failed in one case. A long side splint was applied and an X-ray explained the cause of failure. The fracture line began transversely, but about half way through the bone ran upward obliquely, and this long spike on the lower fragment evidently prevented the engaging of the broken ends.

In the ten cases in which the reduction had seemed satisfactory under ether, the X-ray showed a very good reduction with only slight displacement laterally in six cases; two cases showed engagement of the inner and outer sides of the fragments, *i.e.*, lateral displacement; one case showed postero-anterior edges engaged, *i.e.*, anteroposterior displacement; and one case showed over-riding with lateral displacement. A week's delay ensued before a radiograph was taken in the last mentioned case, and a second attempt to correct the deformity on the tenth day failed. A second X-ray two weeks after the injury showed a bony shadow in the region of the periosteal bridge and, as the leg had measured ¼ inch shorter than the normal leg, the condition was left uncorrected.

The incomplete fracture was straightened and a plaster spica applied.

Nine cases were treated by vertical suspension of both legs (the case in which primary reduction under ether failed is included). At the end of ten days, measurements and local palpation seemed to show a satisfactory result but the radiograph showed over-riding with lateral displacement in two cases which could not be corrected. In general the radiographs showed the same variety of replacement as in the reductions under ether, with this exception, that the spiral fracture showed some overlapping of the ends although the apposition was good. The extension was removed and a plaster spica applied as above.

The plaster spica was worn for ten weeks in all cases and the children allowed up and about in the twelfth week without support, except in the cases with over-riding in which union was not solid for from two to four weeks longer.

Massage and movement were employed after the plaster was removed.

Result: Six cases showed shortening of from one-eighth to three-eighths of an inch (the spiral fracture, the three cases with over-riding, and two cases treated by vertical suspension) ; and the most marked shortening occurred in the cases with overlapping of the fragments.

Solid union took place in all the cases with perfect function and no limp. There was no deformity other than the shortening mentioned above, except a slight anteroposterior bowing in the incomplete case and tilting of the pelvis in those cases with shortening. In one case (W., girl, age 5, Dr. Stimson's service, New York Hospital, 1903) treated by vertical suspension for a transverse fracture at the junction of the middle and lower third of the left femur, the note on discharge states that the leg was one-eighth inch short. Seven and one-half years later, Feb., 1911, the child came to the Out-patient Department of the New York Hospital for another condition, and at that time the two legs were of equal length. There was a difference of circumference of five-eighths of an inch four inches above the patella on the left side, *i.e.*, the left thigh was smaller than the right.

The writer has measured two other cases, six and four years after injury, but has found no apparent change in length from that stated at the time of discharge. Whether this discrepancy was due to error in measurement at the time of discharge or due to more growth on the affected side must remain unsolved.

Twenty cases of fracture of the middle two-fourths of the femur in adults have been followed. The patients ranged in age from 15 to 76 years.

The line of fracture was transverse in ten and oblique in ten cases.

Shortening of the affected leg of from one to four inches was present on admission.

Five cases were treated by the Hodgins splint with additional traction as recommended by Dr. Stimson;[12] four cases were treated by a modification of the incline plane (the thigh piece was inclined while the lower leg piece ran horizontally as in the Zuppinger[13] apparatus) with additional traction by a weight pulling in the axis of the inclined thigh; ten cases were treated by Buck's extension on the Volkmann sliding rest with the counter-extension advised by Bardenheuer,[14] and one case was reduced under anæsthesia as soon as seen (v. infra).

At the end of from one week to ten days' extension, an X-ray was taken and measurements made. In none of the cases did these investigations show a complete end-to-end reduction of the fracture, but the apposition seemed satisfactory in all except four of the cases. In these four, the over-riding could not be overcome and they were operated upon by methods to be discussed later. Two had been treated by Buck's extension, one by the Hodgins splint, and one on the modified plane. Two were transverse in type and two were oblique fractures.

After three weeks' extension (15 cases), a plaster spica was applied for from four to six weeks and then a long side splint of moulded plaster, and massage, movements, and baking begun. Weight-bearing was permitted in the young adults in the fifteenth week, without support, but a short side splint was worn by the patients past 38 for from three to six weeks longer.

One case, John G. (House of Relief, May, 1911, Dr. F. W. Murray's service) was brought to the hospital while the writer was present. He was immediately anæsthetized and a transverse fracture of the mid-third of the left femur reduced by the traction method mentioned above. The two fragments seemed engaged and an X-ray taken at once showed the bones end to end with a little lateral displacement, as shown by the anterior view (Fig. 9). A plaster spica was then applied and a second set of radiographs made, which showed practically the same position as the first set, *i.e.,* there was no difficulty in maintaining the position obtained. The subsequent treatment was carried out by Dr.

R. T. Wheeler, of Brooklyn, at the patient's home. Dr. Wheeler reports that the patient has perfect function and no shortening.

In all but two of the above 16 cases there was shortening of from one-eighth to five-eighths of an inch. In the two cases without shortening, one was the transverse fracture in the patient John G., described above and the other was a long oblique fracture treated by the Buck's extension, etc.

Function was perfect in all the cases except one. In this last mentioned case a limp existed which disappeared when the heel of the shoe was raised one-half inch (there was five-eighths inch shortening).

Four cases were operated upon in the above list, and the operation in each case was done after the failure of some type of extension.

Case I.—Julia R., age 50, New York Hospital, 1903, Dr. Hartley's service. Transverse fracture lower third right femur. Buck's extension. No union at the end of 14 weeks. Operation by Dr. Hartley, ends of bone freshened and a freshly prepared thigh bone of a chicken inserted into the medullary canal on both sides, two chromic sutures through drill holes in the bone, plaster spica. X-ray showed bones in perfect apposition. Primary union of wound. Bone solid in 71 days. The chicken bone could be seen in the X-ray picture up to the eighth month when it disappeared. Examination June, 1910: Perfect function, one-half inch shortening and no limp. The heel of the shoe was raised to compensate for the shortening.

Cases II and III.—One transverse, one oblique in anteroposterior direction, were operated upon after ten days' extension for deformity in over-riding. Deformity corrected, two heavy chromic gut sutures through drill holes in the fragments, plaster spica. Primary union of the wound in both cases (both were robust males 25 and 29 years of age). X-ray showed good but not perfect apposition in both cases and the bone was solid in 60 and 69 days respectively. Shortening of one-eighth inch in the transverse case and three-eighths inch in the oblique case. Function was perfect in both cases and the pelvic tilting readily compensated for the difference in leg length.

Case IV.—R., Bellevue Hospital, Dr. Woolsey's service, 1910. Two inches shortening after traction for two weeks. Eight-screw Lane's plate for fracture at the junction of the middle and lower third of the left femur. Plaster spica with window. Afebrile temperature for two weeks. On the fourteenth day a little pouting of the wound was found. This was opened and an abscess which contained the colon bacillus and which reached to the bone was emptied. The abscess was freely drained but the patient succumbed 27 days after the operation. The immediate cause of death was œdema of the lungs, due undoubtedly to the patient's inability to overcome the existing infection. The writer believes that the fault lay in his selecting this case for any type of operation, as the patient had a marked alcoholic history, arteriosclerosis, and was a bad operative risk. It would have been wiser to have left well enough alone despite the bad deformity which would have resulted (operation by Dr. Hitzrot).

Fractures of the Lower End of the Femur.—In this type are included only those cases of fracture of the condyles and the shaft immediately above them.

Six cases were fractures just above the condyles. Three were fractures of the internal condyle and one was a fracture of the external condyle with crushing of the articular surface of the external tuberosity of the tibia.

Four of the supracondylar fractures were almost transverse in type, the line of fracture running just above the internal condyle slightly obliquely outward. In one case the shaft penetrated the cancellous bone in the upper portion of the lower fragment.

The deformity was the same in all four cases, *i.e.*, outward displacement of the lower leg and genu valgum.

All were reduced under ether as soon as admitted, and the X-ray after reduction showed a satisfactory result in all except one case (M., Bellevue Hospital, 1909, Dr. Hartwell's service). In the latter open operation was done after a second attempt at reduction had failed, the bone fragments pried into apposition, where they remained without any further fixation.

Moulded plaster in all cases for ten weeks, then massage, baking, motion, etc.

In three cases the function was almost perfect, there being less than 5 degrees loss of flexion. In the operative case the knee was slightly more in the valgus position than on the normal side.

In the case with crushing of the lower fragment (Mrs. B. age 50, New York Hospital, 1909, Dr. Johnson's service), but in which the radiograph shows a perfect reduction, flexion was limited to a right angle. After long use the knee was also painful.

Two cases were oblique fractures just above the condyles with the obliquity running from the anterior surface below upward and backward. In these there was the characteristic flexion of the lower fragment. Both were treated on the double incline plane with additional traction by adhesive plaster in the long axis of the thigh. In neither case was flexion of the lower fragment completely overcome. Solid union occurred with one-quarter inch shortening and limitation of flexion of from 10 degrees to 20 degrees, the latter being most marked in the case of the older of the two patients (J. B., age 57, Bellevue Hospital, Dr. Gwyer's service, 1907). Slight anteroposterior bowing was evident in the latter case, although the X-ray showed practically the same degree of reduction in both.

The three cases of internal condylar fractures were treated by reduction under ether and circular plaster. In all, the X-ray showed very little displacement, although the line of fracture was quite distinct and the long oblique upper end of the lower fragment could be seen projecting beyond the contour of the bone. Care was taken to have the leg alignment (anterior superior spine, mid-patella and mid-ankle line) the same as in the opposite limb.

Result: Perfect function without any deformity other than slight widening of the condyles in two cases. In one case (a female, Isabella W., Bellevue Hospital, 1908, Dr. Woolsey's service) the lower leg was adducted too much, so that there was less than the normal knock-knee on the affected side, but the function, etc., were as good as in the other cases.

In the case with fracture of the external condyle with a crushing fracture of the external tuberosity of the tibia, there was little displacement of the femoral condyle but marked genu valgum. The limb was adducted as much as possible and put up in plaster. Result: Genu valgum marked on affected side (the patient originally was slightly bow-legged) with limitation of flexion to a right angle. Later flat-foot developed in the foot on the affected side. An X-ray three weeks after reduction showed a nearly perfect reduction of the fracture of the femoral condyle but marked crushing of the articular facet of the external tuberosity of the tibia.

The Tibia and Fibula.—Eighty-five cases of fractures of these two bones were followed; 15 cases were in children under 10 years and 70 cases were in adults between 17 and 60 years.

Types of fracture: In 35 cases the line of fracture was transverse, in 47 it was oblique, in one case it was spiral, and two of the cases were oblique fractures with comminution. In all except two of the cases the line of fracture in the fibula was at a higher level than that in the tibia, and in these two cases it was found at the same level.

No characteristic type of deformity, other than the angulation at the site of the fracture, change in the line of the tibial crest, and shortening of the tibia, was present.

All cases were treated by immediate reduction when seen and an anæsthetic was given for the reduction. Traction was made on the foot and counter-traction by a sheet over the body under the perineum. Then by local manipulation the fragments were brought into alignment, *i.e.*, the subcutaneous line of the tibial crest was brought into alignment. This was most easily done in children and in elderly individuals and with much more difficulty in robust muscular adults. It was also easier to approximate the transverse fractures than the other types. When reduction was accomplished, moulded plaster splints were applied which included the foot, ankle, and knee, first a posterior one and then a long U-shaped splint on each side, leaving the tibial crest free for determining any change in the line of the crest. The results were confirmed by X-ray pictures. At the end of two weeks the splints were so cut that motion in the knee became possible and massage was begun. In the third week baking of the ankle was begun.

In two cases of oblique fracture reduction was not considered satisfactory and a second reduction under anæsthesia was done within the first week. Perfect reduction was obtained in 30 of the transverse cases, and so nearly perfect in 37 oblique cases that one may call it so. In the remaining cases, 4 transverse, 10 oblique, 1 spiral, 2 comminuted, the alignment was good and the approximation sufficiently fair to warrant leaving the reduction.

Result: Delayed union occurred in two cases, one transverse and one oblique, which came under observation one week and ten days respectively after the injury with circular plaster about the unreduced fracture. Under anæsthesia the deformity was corrected as much as possible. Union became solid in one case in four months (transverse), in the other case (V., New York Hospital, 1905, oblique), in six months. In both cases a leather laced brace was worn after the second month and the patient allowed to use the leg. In both cases slight bowing occurred in the tibia and shortening of three-eighths and one-half inches respectively. Function was perfect in both cases.

Slight lateral angulation at the seat of fracture caused bowing of the tibia with the concavity inward in 12 cases. In 21 cases there was shortening of the tibia from one-sixteenth to one-quarter inch. In two cases a distinct knob remained at the seat of fracture (excessive callus). One case developed flat-foot.

Function was perfect in all cases.

The time at which union became solid varied according to the age of the patient, *i.e.*, it occurred most rapidly in children (4 to 5 weeks), in young adults in from 5 to 8 weeks, and in the patients past forty in from 6 to 14 weeks. The two cases of delayed union mentioned above were in men past fifty but are not included in the above statement.

Pott's Fracture.—Sixty-four cases of this lesion were traced after one year from the time of the injury; 54 were in men and 10 in women.

All presented the picture typical of this fracture and all were treated by the method recommended by Stimson (*loc. cit.*). The splints were removed in from 5 to 7 weeks, most frequently at the earlier period. Massage and baking were begun in the second week and movement when the splints were removed.

In interpreting the results, it was necessary to separate those patients over 55 years of age from the others to get a fair idea of the actual end result.

Thirty-eight cases were in individuals under 35 years and all had perfect function, flexion and extension at the ankle-joint practically the same in both legs, and no pain.

Twelve cases were in patients between 35 and 50. Function was perfect in all the cases. Extension was normal, but there was distinct limitation of flexion in all. Two cases had pain, dull, aching in character after prolonged use.

Fourteen cases were in patients between 55 and 64. Function was perfect in four only, five had practically a stiff joint, and the remainder had motion enough to walk satisfactorily on the level but had difficulty on any incline and on steps. Flexion and extension were limited in all and in five as stated above there was the barest possible motion. All had pain with barometric changes and 9 cases had pain after use.

CONCLUSIONS.

The writer believes that that method of treatment which offers the patient the most satisfactory functional result with the least danger should be the method of election in the treatment of the great majority of simple fractures.

That the future will show, as the cases above have shown, that the method which most nearly fulfils the above requirements is the non-operative reduction of fractures.

That the more experienced the profession becomes in the handling of fractures the better the results will be.

That operation must be considered not the method of election, but the method of selection for a carefully chosen group of cases, and that in selecting the types for operation, each case must be considered a law unto itself.

The writer begs to acknowledge his indebtedness to the attending surgeons of the New York Hospital and the Second Division of Bellevue Hospital for the material from which this study is made.

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LUXATION OF THE ULNA FORWARD AT THE WRIST (WITHOUT FRACTURE).

WITH REPORT OF A CASE.

BY F. J. COTTON, M.D.,
OF BOSTON, MASS.
First Assistant Surgeon in the Boston City Hospital,

AND

W. J. BRICKLEY, M.D.,
Resident Surgeon in the Haymarket Square Relief Station.

THE case herewith reported is presented, as such cases traditionally are, after a careful search of the available literature for data.

Probably we have missed a case here and there, but after all it is not important whether ours is the twenty-seventh or twenty-eighth.

Luxations of this type are so excessively rare that few men have seen them.

To bring to the attention of the profession a rare lesion that by its very rarity might prove perplexing, to satisfy curiosity as to its mechanism of production, and best of all to point out the method for its easy and efficient treatment—these things are perhaps worth doing.

On April 12, 1911, an Italian of about forty-five, strongly-made but small-boned, was brought into the Haymarket Square Relief Station of the Boston City Hospital.

Dr. Brickley, the surgeon on duty, recognized the lesion presented and its rarity, and called me up as a matter of interest.

When we examined the case together the condition shown in the sketches was conspicuous—a loss in the breadth of the wrist, an increase in depth (not conspicuous, however), and a very curious outline of the wrist seen from the back and from the outer side. There was some limitation of motion; the hand was held in semipronation.

The detailed tests were in some degree less easy because the man spoke little English and was rather full of liquor.

The history (gotten then, confirmed next day) was that he was engaged in unloading beer-kegs from a wagon on to a platform that stood at about the height of his shoulder or a bit higher; he was pushing on a keg when it slipped or proved too much for his strength. Hand and radius were displaced suddenly backward from the muscularly fixed ulna. The hand and radius were dislocated backward by the sheer tearing of ligaments under force. In the usual phrase, the *ulna* was dislocated *forward* and slightly inward, so that it overlapped the radius a little in front. A glance at the sketches shows the character of the deformity better than it can be put into words (Fig. 1).

After the patient was anæsthetized, Dr. Brickley attempted reduction by traction combined with direct pressure on the displaced ulnar head. On suggestion he combined with these manœuvres a sharp pronation of the arm, and the bone slipped into its appointed place with a click. All motions became free and all deformity disappeared; splints were applied.

Next day the patient was sent to the "Main" City Hospital and there an X-ray plate was taken, a print from which is here reproduced (Fig. 2). There was no sign of any associated fracture. It has been impossible to trace this patient more recently, and our belief in a good resulting function is one of inference only.

This lesion—uncomplicated forward luxation of the ulna at the wrist—seems first to have been described in any adequate fashion in an article published one hundred and twenty years ago in the "Journal de Chirurgie par P. Desault" for the year 1791. This is in volume i, No. 1, page 78, and is but an extract of an unpublished talk by Desault delivered before the "Académie de Chirurgie" in the year 1777.

The case involved was a cadaver case, without history, but was undoubtedly a case of forward luxation of the ulna alone, without fracture.

Dupuytren saw and reported a couple of cases in his book published in 1834.

Malgaigne, later, collected a series of these cases, in his "Fractures and Luxations," which appeared in 1855.

Many years after, in 1874, Tillmanns[1] again worked up the subject and collected all records of ulnar luxations at the wrist, of which a minority were luxations of the ulna forward of the type with which the present paper is concerned. A more recent collection is by Baum, published in 1902.

Not all of these cases will pass, for in a number of them no account is taken of the question of associated Colles's fracture. Every working surgeon knows that forward subluxation of the ulna, or rarely total luxation, is an almost constant concomitant of this fracture, provided there has been any considerable displacement.

For our present purpose only the cases of *independent* luxation of the ulna forward are of interest.

It would not be fair to admit only those cases in which the X-ray shows no associated radial lesion, for many of the ancient reports bear evidence of very careful observation; yet it is fair to consider only such cases of to-day as have been so tested, to sift the cases of earlier years, and to admit only those that *seem* to belong to the class of forward luxations of the ulna at the wrist, *without* associated radial lesions.

The list later given is an attempt to sift these cases, and includes all cases we have been able to find that pass the test.

The lesion being rare has been the more carefully studied for that reason—a paradox familiar to every one who reads surgical literature; and there are as usual several theories of mechanism on record, and projected and applied reductions in plenty.

The facts seem to be as follows:

The lesion is rare; it occurs only as the result of much force, applied suddenly or slowly.

There seems to be two mechanisms at least: (*a*) forced

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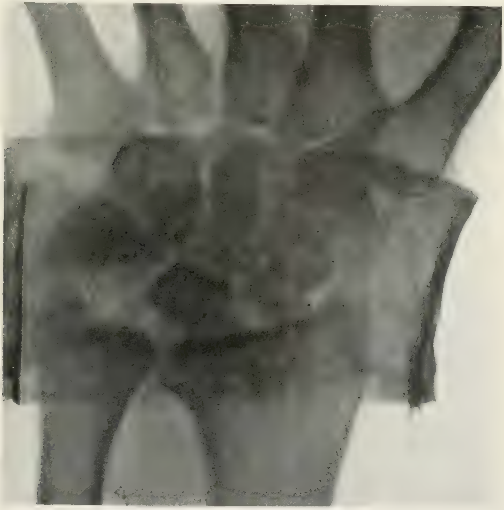
[1] Tillmanns: Archiv. f. Heilkunde, 1874, p. 249.

FIG. 1.

Sketches of the wrist before reduction—from the back and from the radial side. Note the narrowness of the wrist and the sharp edge of the radius next the hollow left by the ulna.

FIG. 2.



Skiagraph taken after reduction of the dislocation. There is no fracture.

supination (Cases 7, 8, 11, 12, 16, 20, 25); (*b*) direct backward shove on the hand with the ulna fixed by mechanical impediment (Case 15) or by the force of the triceps (Cases 3, 21, and our case).

The other mechanisms apparently different are probably reducible to one or another of these.

The lesion is a tearing loose of the lower end of the ulna from most or all of its ligaments, and its displacement forward. Rarely it goes only forward; in most cases there is clearly described the displacement outward so that the ulnar head somewhat overlaps the radius seen from the front, as in our case, coming to lie under the common flexor tendon group, deeply buried.

Pronation is lost; flexion, extension, and finger motion are only moderately interfered with.

The amount of hæmatoma and swelling, of pain and disability need not be very great.

The diagnosis is simple. The wrist is curiously narrow (see Fig. 1).

The normal prominence of the ulnar head at the back of the wrist is gone, and in its place is a hollow beginning above in a gradual slope, bounded at the side by the sharp edge of the radius, below by the rather abrupt edge of the now prominent cuneiform. The ulnar head is not nearly as obvious in front as one would expect; it is of course covered by the flexor tendons, but even at that the anteroposterior diameter of the wrist is not conspicuously increased.

Reduction in these cases is more difficult than one would expect. Dupuytren had good luck with direct pressure backward on the head (cf. Cases 2 and 3).

Boyer devised an elaborate scheme of reduction by shoving thumb and fingers between the bones front and back—a sort of *distraction* reduction. This worked fairly well (cf. Cases 7, 6, etc.).

Best of all perhaps is a combination of moderate traction with direct pressure backward on the ulnar head, *accompanied by forced pronation.*

This solved the trouble in our case, as it did in most of the listed cases.

The *form* of after-treatment is not of first importance. In only two cases (Cases 17, 24) was there any tendency to recurrence of the luxation.

Repair is prompt; in the vigorous young men of the series a fortnight was enough for apparently serviceable recovery, though no doubt another week or two of care would be wise.

The end results, in cases in which recognition and reduction of the lesion have not been unduly delayed, have been admirably good, practically always perfect.

LIST OF RECORDED CASES.

(The list is roughly chronological; the numbers are the reference numbers used in the text.)

1. Desault: Cadaver case; typical luxation; no history (*Journal de Chirurgie,* vol. i, No. 1, p. 78).

2. Dupuytren: Soldier of 32 years of age; fell with his horse. Type luxation; reduced by direct pressure.

3. Dupuytren: A builder thrust violently with his hand against a wall that threatened to fall, and so dislocated the ulna forward at the wrist. Reduction as in Case 2. (Dupuytren, *Lecons orales de Clinique Chirurgicale,* 1834, vol. iv, pp. 503 ff.)

4. Palletta: A slightly doubtful case; cadaver specimen; subluxation only (quoted in detail by Rognetta, *Archives gén. de Méd.,* 1834, ii S., Tome v, p. 405).

5. Valleteau (reported by Espiaud): Boy of 13, who had his wrist twisted in a moving wheel, received a *compound* forward luxation of the ulna. This was reduced and gave, in the end, excellent function.

6. Valleteau (reported by Espiaud): Cannoneer, thrown, and had wrist run over. Reduced by "Boyer's method," but without pronation. (Cases 5 and 6 were reported by Espiaud for Valleteau, *Gaz. Méd. de Paris,* 1836, ii S., Tome iv, p. 250).

7. Boyer: Luxation by forced supination of the wrist (wrist-twisting in a "scrap") in an elderly woman. Reduced by "Boyer's method," combining sharp pronation with the distraction manœuvre (quoted by Malgaigne, *Traité d. Fractures et d. Luxations,* 1855, vol. ii, p. 687).

8. Godelier: Luxation by rolling of a heavy weight on to the fixed and supinated wrist. Reduced by abduction and pronation (quoted by Malgaigne, *loc. citat.*).

9. Malle: Fall on the supinated arm. Reduced by "Boyer's method."

10. Malle: Reduced according to Boyer (quoted by Malgaigne,

loc. citat., without details, with reference only to an inaccessible old military journal).

11. PARKER, of Liverpool: Man of 40, had his wrist pinned down by the shaft of a cart. The hand was supinated, and pronation was lost. Head of ulna under flexor tendons. Reduced by forcible pronation with direct pressure (quoted by Hamilton, "Fractures and Dislocations," 3d. ed., p. 117).

12. DUCHAUSSOY: Carpenter, 28 years old, caught in machine, in supination; reduced by abduction and flexion. Pronation and supination remained somewhat limited (*L'Union Médicale,* 1855, Tome ix, p. 575).

13. PURDOM (quoted as Purdon by Baum): Hand and arm caught between rollers of a planer (obliquely). Typical lesion, reduced by traction and pressure (*Edinburg Medical Journal,* 1874, xx, p. 325).

14. OHLEMAN: Man of 42; arm pinned between body of horse and crib. Hand thenceforth useless. Deformity typical. Reduction by traction and direct shove on the ulnar head. Perfect result (*Archiv. f. klin. Chirurgie,* 1875, xviii, p. 423).

15. R. F. WEIR: Woman of 48; hand and forearm caught in a dumbwaiter in supination. Type deformity. Reduction by direct thrust. Power to pronate returned promptly. Result perfect (*Hospital Gazette and Archives of Clinical Surgery,* New York, 1877, vol ii, p. 10).

16. STIERLIN: Man of 66; was putting on a belt (on shafting) when his hand was caught in supination. Type deformity. Reduction by pressure (*Correspondenz Blatt f. Schweiz. Aerzte.,* xix, 1889, S. 684).

17. BRIGGS: Woman of 72; fell with her wrist caught and jammed. Type deformity. Reduction by traction and direct pressure. Partial recurrence at 8 days; re-reduction. Final result excellent (*N. Y. Medical Record,* May 9, 1891, p. 553).

18. WEIZ: Quoted by Baum without a reference.

19. JONES: Male of 35. Was struck by the "kick" of a machine in the palm—given as over pronation (?). Type deformity with lost rotation, etc. Reduced by extension and *supination* (*Lancet,* 1893, i, p. 862).

20. WHITE: Hand caught in a belt. Type deformity. Reduced (under chloroform) by traction and direct pressure (*British Medical Journal,* 1893, i, p. 641).

21. KIRKBY-THOMAS: On board ship a man had his wrist struck by a heavy swinging loading hook. Typical deformity. Reduction by pressure and pronation (*British Med. Journal,* 1896, ii, 1774).

22. LEISTENDORFER: Soldier, hand slipped in exercise-vaulting and he fell over it. Type luxation. Reduced by abduction and pronation. Rapid and permanent recovery (*Deutsche Militar-ärztliche Ztschr.,* Berlin, 1896, xxi, S. 333).

23. BAUM: Male of 44 years; arm struck by a stone. Type luxation except that the ulnar styloid was broken (*Deutsche Ztschr. f. Chirurgie,* Bd. 67, 1902, S. 645).

24. VALLAS: Patient struck the ulnar side of the arm on a rail in falling. Typical displacement. Reduction by pronation, recurrence on

supination. Was again reduced by pronation. Some ulnar nerve tingling after this manipulation (*Lyon Méd.*, 1904, Tome 103, p. 885).

25. THON: Male of 50, had hold of a rope running over a limb. This hand was dragged over by the running rope in forced supination. Reduction by traction and pronation (*Deutsche Ztschr. f. Chirurgie,* lxxxiv, 1906, S. 257).

26. HAEDKE: Woman of 63, wrist twisted in a quarrel; thought to have been pronated. Typical volar luxation of ulna (*Deutsche Ztschr. f. Chirurgie,* 1907, vol. xci, p. 429).

27. HILL: Male, age 52 years, while cranking his automobile the motor back-fired, throwing his hand in violent supination, causing a rupture of the internal lateral ligament and anterior ligaments, and tearing the triangular interarticular fibrocartilage, resulting in a forward displacement of the head of the ulna where it could be felt under the flexor tendons with a very perceptible corresponding backward depression. The patient, when seen shortly after the accident, was suffering greatly. The pain was not materially increased by flexion and extension, but pronation and supination added greatly to his discomfort. Flexion of the forearm and pressing the head toward the sigmoid cavity of the radius during extension and counter-extension made reduction easy, but the application of splints for five weeks did not prevent redisplacement to some extent. Patient still complains of a weakness especially in pronating. There was no clinical manifestation of fracture of the radius nor did an X-ray picture show the slightest sign of one anywhere. (Personal communication from Dr. L. L. Hill, of Montgomery, Ala.)

OSTEOMYELITIS OF THE LONG BONES.*

A STUDY OF NINETY-FOUR CASES FROM THE CHILDREN'S HOSPITAL, BOSTON.

BY JOHN HOMANS, M.D.,

OF BOSTON, MASS.

Assistant in Surgery, Harvard Medical School; Surgeon to Out-Patients, Massachusetts General Hospital.

THE series of cases upon which this paper is based includes all those which have been treated at the Children's Hospital since the publication in 1904 of Nichols's [1] classic monograph, which placed the pathology and treatment of osteomyelitis upon a sound and enduring basis. A study of these recent cases, though it brings out nothing essentially new, emphasizes some tendencies of the disease which are certainly worth recording.

It is not my purpose to cover by a mass of statistics every side of this subject, but to illustrate the manner in which infection seeks out and works upon the different bones, the variations in the course and virulence of the disease, the value of the Röntgen ray in diagnosis and treatment, and, finally, the results of the treatment itself.

Localization.—In going over a long series of cases, it has been a very striking observation that the first evidence of disease has appeared at one end or the other of the infected bone. In other words, the history has generally shown that it was not the thigh, leg, arm, or forearm, which first became painful, swollen, and tender, but the hip, knee, ankle, shoulder, elbow, or wrist. In most of the instances in which the history has failed to give evidence upon this point, the Röntgen plates have supplied the lack by identifying the original focus of infection. In a few cases the disease has been so rapidly fatal that the primary focus has been impossible of identification, and in about an equal number, the infection has evidently invaded the shaft from the periosteum at a distance from a joint

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* Read before the Boston Orthopædic Club, November 13, 1911.

Several years ago Stone[2] called attention to the fact that many infections of the long bones, which occur in or near the epiphyseal line, break out from the bone at that point, and may then produce an extensive abscess beneath the periosteum of the diaphysis with but slight involvement of the medullary cavity. While a study of this series does not show this to be a common occurrence, it does indicate that the primary focus is nearly always to be found in the end of the diaphysis, and that it frequently remains local or breaks out from the bone through the epiphyseal line without spreading far into the medulla of the shaft.

I submit the following figures to illustrate this point. Among 94 patients, the number of bones infected (excluding the lower jaw and the small bones) was 113. Of these 113, there is evidence in the history or Röntgen plates (or both) that in 95 the primary focus appeared in one or the other end of the diaphysis. To answer the possible objection that the neighborhood of the joint appears to be the original seat of disease only because the inflammatory products find their way to the surface most easily at this point, I will say that in no instance does the Röntgen plate contradict the history as to the position of the original focus, and moreover, as will be shown later, the study of a series of plates taken in the early stages of an extensive disease of any bone will generally disclose the original focus.

This same line of investigation gives evidence rather at variance with the findings of Le Conte,[3] recently published, with regard to the periosteal origin of infections of the medulla. Le Conte gives the impression that he considers the penetration of an osteoperiostitis into the medullary cavity a common occurrence. In the Children's Hospital series, this condition is the exception. In only eight bones out of 113 can this process be definitely shown to have occurred, though in the Röntgen plates the appearance of such a lesion is in marked contrast to the usual process originating in the epiphyseal end of the diaphysis (Figs. 1 and 2). In the rare instances, however, of an isolated process situated in the medulla at some distance from one end, it is difficult to say whether the infection penetrated from the outside or not. Of such cases there are four in this series, and in six others there is no evidence whatever as to the position of the primary focus.

I think it may then be assumed that the great bulk of the infections are medullary in origin, and that their primary focus, certainly their earliest manifestation, is found near the epiphyseal line. With this in mind I have attempted to discover whether any particular bones show a preponderance of infections over others, or at one end over another. The following list records the result of this investigation:

Femur, upper end 24, lower end 15 (and one general infection of unknown origin).

Tibia, upper end 12, lower end 19 (and three general infections of unknown origin).

Fibula, upper end 3, lower end 4.

Humerus, upper end 9, lower end 0.

Radius, upper end 0, lower end 4 (and two general infections of unknown origin).

Ulna, upper end 1, lower end 1.

Clavicle, inner end 2.

This list speaks for itself. Disease of the bones of the leg is easily more common than that of the arm. Disease of the femur is somewhat more common than of the tibia, its nearest rival, and of all the regions affected the upper end of the femur presents the most numerous infections. The preponderance of infections of the bones of the leg makes it appear as if the wear and tear of locomotion were accountable for this selection. How far an actual blow or fall is the actual exciting cause, is not clear from the histories. It is generally mentioned, but when one considers the innumerable bruises of childhood it is not strange that some violence can be remembered to have preceded the disease.

Apparently, then, there is good reason to believe that there is something peculiarly open to attack in the region of the epiphyseal lines of the long bones. More than that, the ends of the bones supporting the body are more frequently affected than those of the upper extremity. Possibly the character of the blood supply of the growing part of the bone renders this point particularly vulnerable. Whatever the cause, it is interesting to study the course of these infections according to the anatomical relation of the various epiphyses to the different bones, for if the disease can more easily break out into the soft parts in one region than another, or if perhaps one end of a shaft offers a better structural resistance than another to the spread of infection, we should expect to find variations in the frequency with which each bone becomes completely invaded. There might, indeed, be variations according to age, but as all the children in this series are under twelve and rarely over ten, the differences in the degree of union of the epiphysis with the shaft would probably be negligible.

The following table records the number of infections originating at either end of each long bone, the number of general infections resulting, the percentage of general infections to the total number of infections in each locality and in each bone, the number of general infections of unknown origin, and the number of cases of local disease in the middle shaft. The term general infection refers to a condition in which at least two-thirds of the shaft becomes necrotic.

Origin of infection at upper end	Gen'l infections resulting	Gen'l infections to total No. of infections of upper end	Origin of infection at lower end	Gen'l infections resulting	Gen'l infections to total No. of infections of lower end	Gen'l infections of unknown origin	Mid-shaft infections	Gen'l infections to total No. of infections
		Pct.			*Pct.*			*Pct.*
Femur......... 24*	3	12.5	15	4	26.6	1	1	20
Tibia........... 12	5	41.6	19	5	26.3	3	7	34·2
Fibula......... 3	3	100	4	0	0	0	2	33·3
Humerus....... 9	3	33·3	0	0	0	0	2	27·3
Radius......... 0	0	0	4	4	100	2	0	100
Ulna........... 1	1	100	1	1	100	0	1	66.6
Clavicle (inner end)......... 2	1	50	..	..	....	0	0	50

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* A number of infections classified in the records as osteomyelitis of this region have been excluded though abscesses in the soft parts appeared to lead to bone, either because of a lack of absolute proof of bony involvement, or on account of a possible tuberculous origin.

Perhaps these tables offer too few cases for safe generalization, and possibly the means of identifying a certain portion of the bone as the seat of the primary focus are inadequate, but even if these objections are valid, and I think they are not, the conception of osteomyelitis as a disease originating in or near the epiphyseal line is at least strongly suggested. The upper end of the femur is easily the most common seat of the primary focus, and furnishes as well the lowest percentage of general infections. Taken as a whole, the femur shows a smaller proportion of general disease than any other bone, though its lower end does not differ in this respect from the lower end of the tibia. Examination of the Röntgen plates and operative findings leads to the observation that disease of the upper part of the shaft originates commonly beneath the great trochanter, the head, and the lesser trochanter, the three epiphyses of this region. That such foci should break out to the surface without dissecting up the neighboring periosteum is not strange when we remember the powerful character of the muscular attachment about the upper end of the bone. The failure of the general shaft to become involved is apparently due to the ease with which the inflammatory products can escape from beneath the epiphyses as well as to the solidity of the structure of the upper part of the shaft. The Röntgenographs which illustrate this localized hip infection (Figs. 3, 4 and 5) are taken, in part, from an excellent study of this subject by Legg and George.[4]

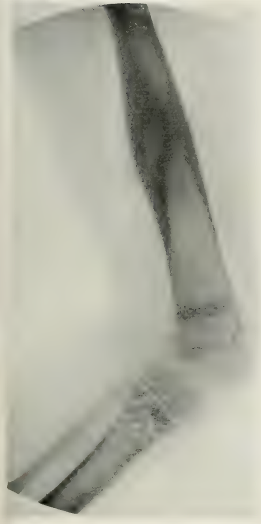
This peculiarity of the femur is all the more remarkable in view of the fact that in both the tibia and fibula general infections more often start from above than below, a tendency which we might perhaps expect as an effect of gravity on drainage. In this respect the humerus can perhaps be placed in the same class with the tibia and fibula, though as there are in this series no records of disease of the lower end, the comparison is not quite fair. This freedom on the part of the end of the humerus which enters into the elbow-joint seems rather extraordinary, considering that the elbow is pretty severely battered in childhood. It indicates, perhaps, that blows and falls are not a very potent influence.

In the smaller bones general infections are the rule, though the total number of cases is small. There are no striking peculiarities among these bones, except that the upper end of the radius shares with the lower end of the humerus a complete freedom from disease.

Variations in the Course and Virulence of Osteomyelitis.— The variations in the course and severity of the disease are well illustrated in this series. In some instances a mild attack has never required operation, and the only evidence of its passage has been a slight alteration in the bone, as shown by the Röntgen ray. In others the onset has extended over months and the cure required a very minor operation. In such cases the diagnosis of rheumatism or tuberculosis is often made. In most instances the onset has been sudden and violent, and the full extent of the destruction of bone has taken place in a few days to two weeks. In the less virulent of these typical infections, the breaking out of the process from the epiphyseal line has saved the medulla from complete destruction, in much the same way that it is saved by operation, but in the most rapid, the child has died of toxæmia before local evidence of trouble was fully apparent.

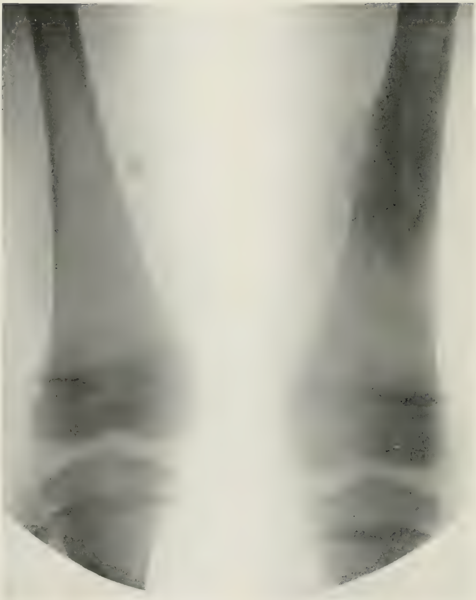
Use of the Röntgen Rays in Diagnosis and Treatment.— While there is no one more valuable aid in the diagnosis and treatment of osteomyelitis than Röntgen plates, the use of this aid is subject to one most important limitation, which has frequently been illustrated at the Children's Hospital. It appears to be a fact that, according to the greater or less rapid destruction of bone in any one case, the Röntgen plate may lag more or less behind in revealing the full amount of damage. Not enough is known, perhaps, of Röntgen ray pathology, so to speak, to say just how soon after a portion of bone has become cut off from its blood supply it will cast an altered shadow upon the plate. And again, a fair plate may not even suggest what a perfect plate will clearly show. Under the circumstances, it is perhaps fair to say that positive evidence in plates taken during the first few days of an acute disease is most important in establishing a diagnosis and localizing the

FIG. 1.



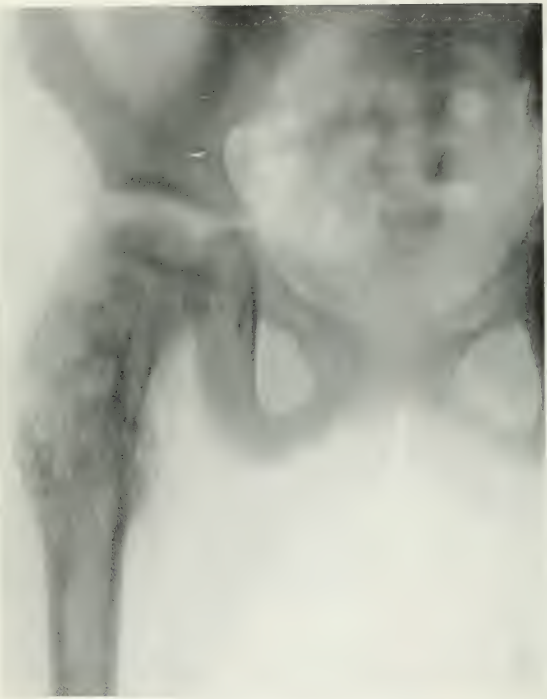
Osteomyelitis of the femur, periosteal origin. Plate taken one year after onset. Compare with Fig. 2, another view of the same bone.

FIG. 2.



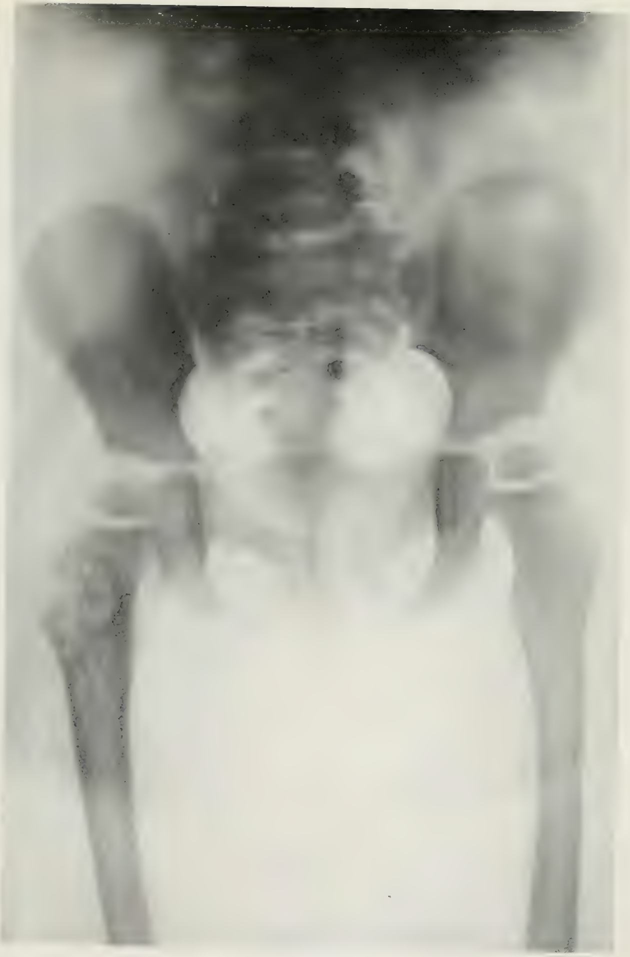
Osteomyelitis of the femur, periosteal origin. Plate taken one year after onset. Compare with Fig. 1, another view of the same bone.

Fig. 3.



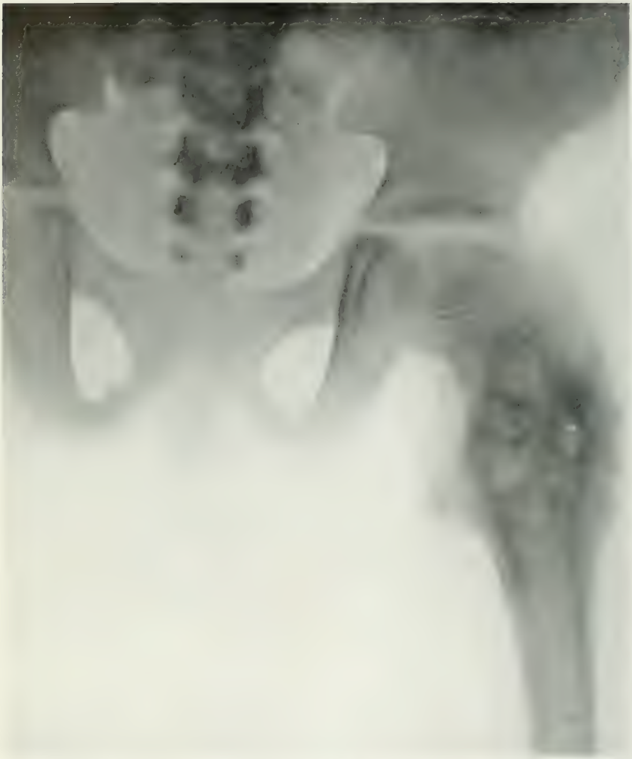
Osteomyelitis of the femur. Origin in the region of the great trochanter. Plate taken six weeks after onset.

Fig. 4.



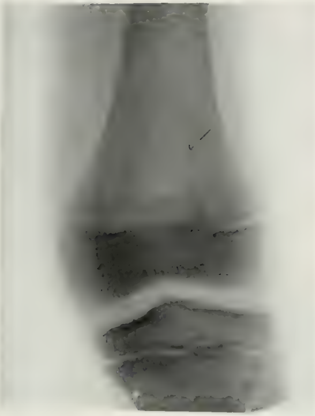
Osteomyelitis of the femur. Origin beneath the great trochanter. Plate taken eight months after onset.

FIG. 5.



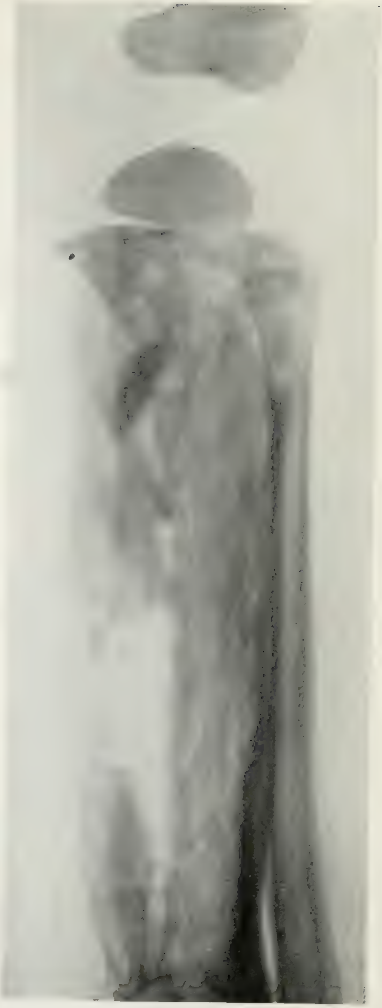
Osteomyelitis of the femur. Origin in the region of the great trochanter. Plate taken five months after onset.

FIG. 6.



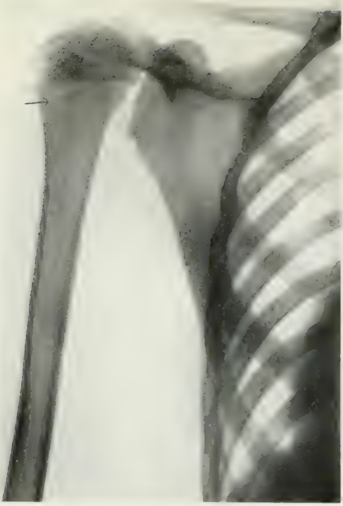
Osteomyelitis of the femur. Subacute onset. Plate taken nine days after onset.

FIG. 7.



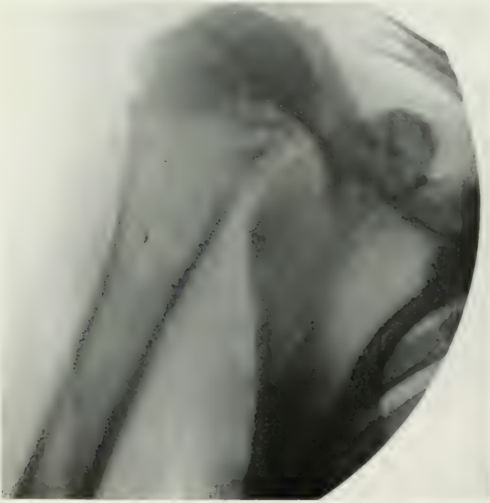
Osteomyelitis of the tibia. Total destruction. Plate taken seven weeks after onset. Resection at this time of the entire sequestrum was followed by regeneration in 30 days.

FIG. 8.



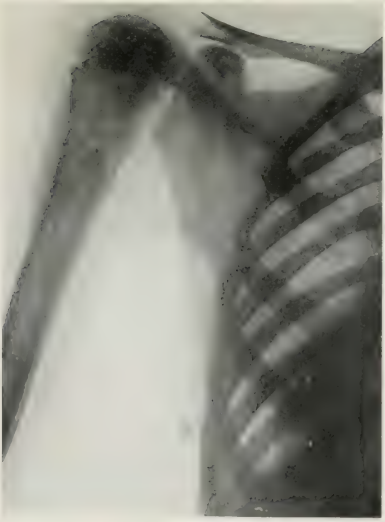
Osteomyelitis of the humerus. Plate taken Feb. 17, 1911, six days after onset. At this time there was found an extensive abscess beneath the deltoid, pus under the periosteum for three inches downward from the epiphyseal line, and pus in the upper end of the medulla of the shaft extending downward from the epiphyseal line for about an inch. Notice the faintness of the indications of bone disease.

FIG. 9.



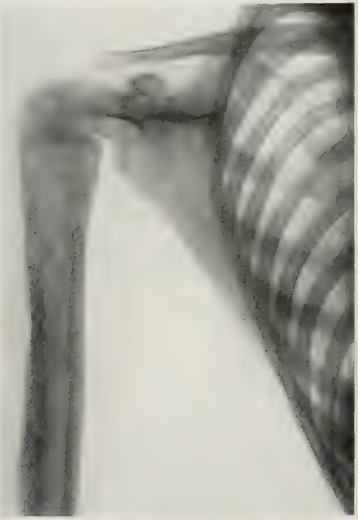
Same case as Fig. 8. Plate taken March 7, 1911, 24 days after onset. The bone has been widely opened to just below the lowest piece of metal shown in the print. Notice the irregular small areas of suppuration below this point and the extent of the periosteal thickening.

Fig. 10.



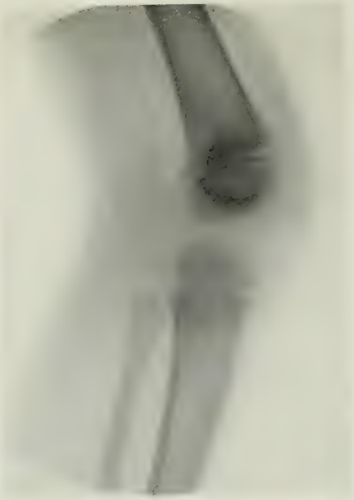
Same case as Figs. 8 and 9. Plate taken eight weeks after onset. Notice regeneration of bone at site of operation and the density and extent of the new periosteal bone.

Fig. 11.



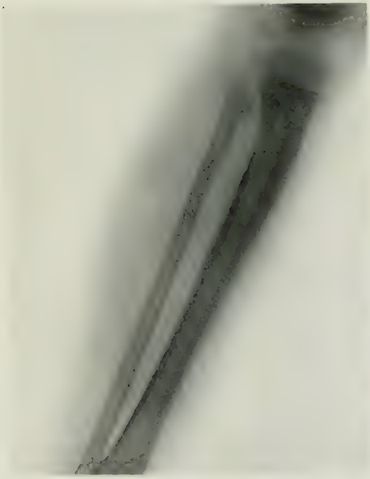
Same case as Figs. 8, 9, and 10. Plate taken seven months after onset. Arm had been healed for three months. Notice welding of periosteal new bone with the shaft.

FIG. 12.



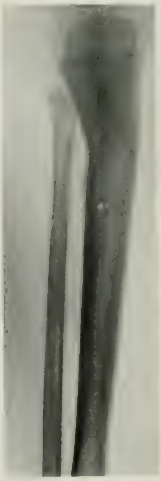
Osteomyelitis of tibia. Plate taken Feb. 8, 1911, ten days after onset. Notice outline of necrotic bone in upper one and a half inches of the shaft next the epiphysis.

FIG. 13.



Same case as Fig. 12. Plate taken March 11, 1911, seven weeks after onset. Notice regeneration of bone at site of operation, and extent of periosteal thickening.

FIG. 14.



Same case as Figs. 12 and 13. Plate taken seven months after onset. The leg has been healed for several months. Notice disappearance of the thickened periosteum.

process, but that negative findings under these circumstances should not be taken seriously, nor positive as indicating the full extent of the lesion.

Fig. 8 shows the upper end of the humerus in a boy of eleven years, who had suffered from severe local symptoms for six days before entrance. There is in the plate but very slight evidence of disease, and yet operation performed at once disclosed an abscess in the upper end of the shaft, extending down for an inch below the epiphyseal line, and pus under the periosteum for two inches farther down. Fig. 9 is a later plate of the same case, and shows that the medulla below the obvious pus cavity in the bone, which appeared normal in the first plate and at operation, was the seat of a less active process which only became visible considerably later.

On the other hand, in locating a well-established focus and in following the changes in the bone once the disease has ceased to advance, the Röntgen plate is absolutely invaluable. It directs the operator to the exact focus (Fig. 6); it advises him of the extent of the necrotic bone (Fig. 4); and it enables him to follow the development of the periosteal new bone, so that he may time his secondary operation correctly, and remove as much necrotic shaft as is necessary at the time when the involucrum is ready to grow into its place (Fig. 7).

Treatment.—Inasmuch as the 94 patients in this series have been treated by a considerable number of surgeons, the treatment has been too varied to be effectively summarized. On the whole, conservatism has been the rule, and the results, so far as I have been able to obtain them, seem to be good (see table). There are in all twelve total resections, and by this I mean a resection of the entire thickness of the shaft for at least two-thirds the length of the diaphysis. These I have divided into three classes: first, those performed immediately after the onset of the disease, before the periosteum has had an opportunity to thicken; second, those performed at the time of election some weeks after the beginning of the infection, according to Nichols's dictum, the periosteum being sewed together and made into a collapsed tube; and last, those performed as in the second class, with the difference that the wound has been packed wide open.

In the first class are two cases:

(1) W. B. Right tibia. Acute onset. General swelling of leg with cellulitis. Subperiosteal resection six days after onset. Periosteum sutured. Result, incomplete regeneration requiring transplantation of fibula. (2) E. C. Left fibula. Acute onset. Cellulitis. Subperiosteal resection three days after onset. Periosteum partly sewed up and the cavity drained with a rubber tube. Regeneration complete.

There are unfortunately too few of these cases from which to draw conclusions. As far as it goes the evidence is against early resection.

In the second class are four cases:

(1) I. S. Left clavicle. Subacute onset. No operation performed for five weeks after onset, when the whole diaphysis was resected subperiosteally and the periosteum sewed up without drainage. Result, complete regeneration. (2) M. D. Osteomyelitis (possibly syphilitic) of right radius. Subacute onset. Subperiosteal resection of most of shaft five weeks after onset. Periosteum sewed up. Result, regeneration after some delay and a minor operation. (3) G. W. Left ulna. Acute onset. Subperiosteal resection six weeks after onset. Periosteum sewed up. Complete rapid regeneration. (4) L. U. Right tibia. Acute onset. Subperiosteal resection seven weeks after onset. Periosteum closed and drain placed at both ends. Complete regeneration in thirty days.

These cases, in which the septic process had died out by the time of the secondary operation, were treated in practically the same way, and in three, excellent results were obtained. The fourth, which was probably syphilitic, did very well while she was followed, but has since been lost to sight.

In the third class are five cases:

(1) D. B. Left ulna. Acute attack. Subperiosteal resection five weeks after onset, the bone being removed in fragments and the wound packed wide open with gauze. Regeneration complete. (2) E. D. Left tibia. Acute onset. Subperiosteal resection nine weeks after onset. Wound lined with rubber

tissue and left wide open. Regeneration complete. (3) A. K. Right fibula. Acute onset. Subperiosteal resection seven weeks after onset. Periosteum closed in central part but cavity drained with iodoform gauze. Wound later required irrigation. Result, partial regeneration. Perfect function. (4) A. M. T. Right tibia. Acute onset. Seven months after onset thick involucrum opened and necrotic shaft removed. Packed with gauze. Result, regeneration with poor cosmetic result. Right humerus. Acute onset. Seven and one-half months after onset thick involucrum opened and necrotic shaft removed. Packed with gauze. Result, regeneration. (5) J. McC. Right fibula. Acute onset. Three months after onset thick periosteum opened and bone removed in fragments. Cavity lined with rubber dam. Result, unknown (patient cannot be traced).

These cases, of the same character as the last, show one failure, but the total number is too small from which to draw conclusions. As far as the results go they speak against packing the periosteal shell with gauze.

I have purposely refrained from discussing at any length the refinements of treatment in complete subperiosteal resection, because I have been unable to see that the results differ very essentially whichever method is used, though, for reasons which will appear later, I cannot believe that any real advantage of the immediate resection outweighs its danger of failure. This brings me to the matter which seems to me far more important than the resection of totally necrotic bone, a step which, like amputation, is, in a way, a confession of failure. I allude to the treatment of the cases in which the disease has remained local, or in which it has not yet infected the entire medullary cavity. Here the primary operation, the one performed when the surgeon first sees the patient, is of the greatest importance, for it is upon this that the excellence of the ultimate result really depends.

The early or primary operation has for its object the saving of life and the limitation of the septic process, two requisites which go hand in hand. In this series there has been an immediate mortality of 7.36 per cent. or 7 cases out of 94.

It is significant that in five of these cases the infected bone was not opened. In another, the bone was opened, and in the last, the history is deficient.

The importance of draining the infected medulla has been too long recognized to require emphasis, and no one ought to hesitate to remove a portion of the cortex, even in the presence of an extensive periostitis, when infection within the bone is in the least suspected. It is in the direction of where and how to drain the bone that this series seems to me to indicate the way, for it has been noticeable that when a painstaking effort has been made to find the original focus and to follow the pus until sound tissues are reached, a secondary operation has been practically unnecessary or minor in character. The principle that the disease almost always starts next to the epiphysis is, therefore, of tremendous importance. The fact that the Röntgen ray will not always indicate the full extent of a process less than a week old is hardly less to be considered. Finally the point made by Nichols, that the endosteum should not be destroyed by reckless curetting, is a third and obvious consideration. The results of treatment carried out on these lines in early acute cases will justify the statement that if the diagnosis is in any way prompt, the actual removal of much of the shaft is a confession of failure. I shall quote from two histories in some detail to illustrate these points. In neither is the treatment free from minor mistakes.

Case I.—C. F., male, age eleven years. Previous history negative. Entered hospital February 17, 1911. Had an attack of "grippe" for three days, two weeks before. Rather poorly until six days before, when he had pain in left shoulder. Shoulder swelled. Diagnosis rheumatism. Physical examination: local heat, swelling, and œdema, in front of left shoulder-joint and a little way down front of arm. Temperature 105.2°. Aspirated and pus obtained. Röntgen plate shows questionable lesion near epiphyseal line (Fig. 8). Operation at once. Deltoid incised about an inch inside bicipital groove. Abscess beneath deltoid. Periosteum tense and fluctuant. Abscess beneath it from bicipital groove outside to back of arm, and for three inches down the shaft. Rough friable bone next to epiphysis on inner posterior surface. Opening one inch square, made with gouge, disclosed abscess in bone with most of pus welling up from behind. Enough of medullary structure curetted out to allow free drainage. Narrow slit chiselled downward for about one inch more, showed healthy looking cortex and medulla. Gauze drainage. *Staphylococcus aureus* in culture. Temperature fell to 100.4° in two days and then rose again.

Feb. 22, five days after operation, opening made in back of shoulder-joint and cloudy fluid escaped. Joint drained with rubber tissue. At same time the opening in inner side of the humerus was rongeured out to the extent shown in the Röntgen plate (Fig. 9). Did well and was healed May 1. On March 11 an infection of the right hip was drained and subsequently healed without complication. No bone involved. On May 14, about three months after original operation, sinus opened of itself at the upper end of the wound in the arm. May 19, secondary operation. Old scar in front of shoulder excised. Involucrum covered old opening in the bone as did a second layer of bone beneath it (evidently from the endosteum, which was as little disturbed in the first operation as possible). (See Röntgenograph taken April 6, Fig. 10.) A clean hole about the dimension of the original was rongeured out and some spicules of dead bone removed. After this, healing was uneventful. Seen in September when the arm had been healed for several months. No disability. Upper part of the bone thick and irregular. Röntgen plate shows that the periosteum which had grown new bone over practically the entire shaft was welding with it (Fig. 11).

This case illustrates the common mistaking of osteomyelitis for rheumatism, the partial failure of the Röntgen ray to demonstrate a lesion six days old, the location of the infection near the epiphyseal line, the free opening of the bone (not far enough at the first operation as it turned out), and the subsidence of the rather general bone infection, as shown by the Röntgen plates, after drainage. The result is not ideal, but shows the possibilities of regeneration of bone, which at first sight appeared necrotic, through the avoidance of unnecessary injury.

Case II.—R. H., male, age five years. Past history negative. Entered hospital February 8, 1911. Ten days before entrance had had a sore throat. Said to have struck right leg against a tree and had complained of pain in lower leg. Swelling of upper right leg just below knee first noticed five days before entrance. Local heat and swelling below right knee extending several inches down the leg. Temperature 102°. Röntgen plate shows disease in upper shaft (Fig. 12). Operation at once. Incision for three inches over inner surface of tibia just below knee. Pus under periosteum and coming from posterior surface. Through a second incision in front of the fibula the posterior and outer surfaces were curetted off downward from the epiphyseal line for one and one-half inches. Cigarette drain. Streptococcus in culture. Good recovery. Successive Röntgen plates show extensive periosteal reaction and rarefying of bone for upper three inches (Fig. 13). April 5, two months after first operation, a small fragment of dead bone was removed and healing from then on was uneventful. Final condition shown in Fig. 14 (plate taken August, 1911). No lameness. About one-half inch lengthening of right tibia.

This case illustrated the success of the thorough early operation and the completeness of repair without subsequent treatment of any importance. Unlike the first case quoted the periosteal new bone which seemed at one time to be forming about the upper part of the shaft disappeared later and left a normal looking cortex. The cause of this difference is one of the mysteries surrounding the behavior of the periosteum.

There is only one more important feature of the treatment of osteomyelitis which this series brings out. This is the effect of rest on healing. Many cases have recovered with good results under traction by hip splints or other forms of immobilization. In some instances a minimum of drainage, followed by long-continued rest and freedom from weight-bearing, has brought about excellent function, but it must be acknowledged that the healing though finally complete has been slow. Such results emphasize the obvious importance of freedom from strain during the repair of bone.

The following summarizes the ultimate results in so far as it has been possible to follow the patients:

Seven died as an immediate effect of the disease.

Forty are alive and well and have a perfect functional result. Of these, three had multiple infections.

Nine are stated in the Out-Patient records to be healed and in good condition, but have not been seen since.

Eleven have healed wounds but some deformity which in no case is disabling.

Seven have unhealed wounds.

Twenty have not been heard from since leaving the hospital.

CONCLUSIONS.

1. Osteomyelitis of the long bones in children originates in the ends of the diaphyses—rarely as a periostitis.

2. It principally attacks the weight-bearing bones.

3. The early or primary operation demands the removal of bone for purposes of drainage only. The infected medulla should be fully uncovered without doing unnecessary damage to the periosteum or endosteum.

4. Considering the power of regeneration of periosteum plus endosteum, early complete resection of a shaft is not advisable; therefore total resection later should be reserved for cases of total necrosis.

5. The Röntgen ray cannot be depended on for diagnosis in the very early stages, but is invaluable in following the course of the disease.

I am indebted to the Röntgenologists of the Children's Hospital, for the plates which illustrate this article, and to the members of the staff for permission to study their cases.

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THE DIAGNOSIS OF DIAPHRAGMATIC HERNIA.

BY H. Z. GIFFIN, M.D.,

OF ROCHESTER, MINNESOTA.

Attending Physician to St. Mary's Hospital.

In obtaining clinical histories from patients, it is well to inquire as to former injury much as one would ask about previous disease or operation. In this manner a clue may be obtained which will occasionally lead to eliciting data of vital importance in the diagnosis. This point is forced upon one's attention in reviewing the reported cases of diaphragmatic hernia. The history of trauma is very important evidence, as will be shown later.

For a discussion of the embryology, anatomy, and pathology of diaphragmatic hernia and related conditions, the reader is referred to articles by Sailer and Rhein, Strüppler, Königer, Beltz, and Becker. Further discussion on the diagnosis will be found as well. It will be impossible to give credit in the text to all authors whose papers have been reviewed. German clinicians have been very thorough in their study of diaphragmatic hernia, and we are indebted to them for most of our information. The fact that little has been written in English upon the differential diagnosis has led me to prepare this discussion.

Many diaphragmatic hernias are congenital, but most of these have been found in stillborn babes or in infants. Hernia occurs through the various normal apertures of the diaphragm. Hernia into the pericardial sac has been reported. Right-sided hernias have, as a rule, been small and have contained a small knob of liver. The stomach has been found in the right side of the chest in one instance. Nearly all diaphragmatic hernias, however, are left-sided, and the subject will therefore be reviewed from this stand-point. Most important for diagnosis are the congenital hernias of adults and traumatic hernias.

About 650 cases of diaphragmatic hernia have been reported. Strüppler collected 500 cases in 1901. One hundred and seven reported cases have been found since then, and in addition 41 references have been collected which the writer has been unable to confirm personally. Most of these were either congenital hernias of babes or symptomless hernias discovered at autopsy. It would seem that 15 cases were diagnosed correctly during life. It is safe to say, however, that many mistakes have been due to the fact that the physician was unprepared for the condition; that the symptoms and signs of diaphragmatic hernia were often quite clear but were not elicited because of lack of familiarity with them. On the other hand, an occasional case has been reported in which all the refinements of Teutonic technic have failed to differentiate the condition.

The most important and difficult differentiation to make is that between diaphragmatic hernia and *elevation of the diaphragm* (*eventration*). "Eventration" of the diaphragm was applied by Petit in 1790 to the condition of chronic idiopathic unilateral elevation of the diaphragm described by him. About 20 cases have been reported in the literature. As Königer suggests, it is not a good term surgically. The surgeon understands by eventration the condition in which a large part of the abdominal viscera is outside the peritoneal cavity. In fact, the word eventration might well be applied to diaphragmatic hernia, but not to high position of the diaphragm. Elevation of the diaphragm would be a better term; it is concise and its meaning is clear.

Elevation of the diaphragm is not an operative condition. Diaphragmatic hernia is generally surgical. The importance of deciding between the two conditions is therefore increased. Cases of elevation have been diagnosed hernia and unnecessarily operated upon.

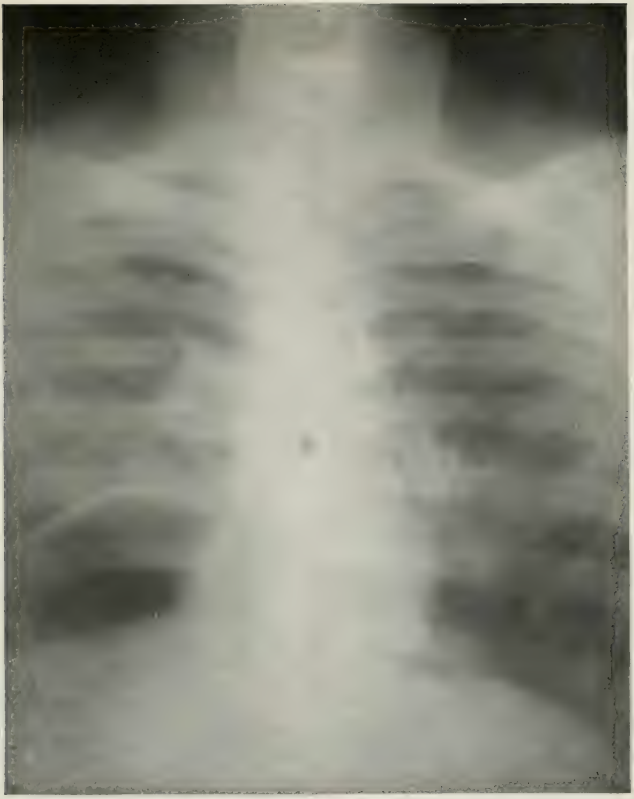
The diagnosis can best be discussed in a consideration of (1) the clinical symptoms, (2) the physical signs and (3) the radiographic and fluoroscopic findings.

If a history of severe trauma be elicited,—a crushing injury to the lower thorax or upper abdomen, as would occur if a man were caught between buffers; a severe blow to the upper abdomen or lower thorax, as in being struck by a flying plank; a severe twist with consequent strain upon the organs of the upper abdomen and the diaphragm, as in being jerked suddenly from one position to another; a sudden doubling of the body with chest between knees, as in a sand or gravel slide; a penetration of tissues in the region of the diaphragm, as in a stab wound,—the existence of rupture of the diaphragm should be suspected. In the acute condition, marked dyspnœa with severe upper abdominal and left thoracic pains, possibly with symptoms of intestinal obstruction and hæmatemesis, completes the clinical picture.

Chronic cases of hernia, either congenital or traumatic, may give a less striking symptomatology and a history of much less severe injury. In this they approach the symptoms of elevation of the diaphragm, where abdominal pain. dyspnœa, and vomiting, though less severe, may recur in attacks, and these may be worse after trauma without rupture being present. Elevation is generally a congenital condition. A prominent symptomatology may only follow trauma. Dyspnœa, pain, indefinite gastric complaints may be of varying grades. Hæmatemesis has been reported. It is in these chronic cases then that the physical findings and radiographic and fluoroscopic study are more important.

Tympanitic percussion note, distant breath sounds, gurgling and tinkling sounds over the left lower chest, with hyper-resonant note and normal or slightly altered sounds over the left upper chest are common to both conditions. The heart is displaced to the right. In diaphragmatic hernia Litten's sign may be absent, and it has been suggested that the line of tympany may be less movable than in elevation. Dulness below tympany has been noted in diaphragmatic hernia and is probably explained in one case on record by the presence of spleen and in another by omentum. After giving a Seidlitz powder the signs may be much clearer and expansion of the stomach upward is likely to be more decided in hernia. Filling the stomach with water will cause partial flatness in place of tympany. Air or water pumped into the colon will likewise affect the tympany in the chest, if the

FIG. 1.



June 26, 1911. Case, diaphragmatic hernia, with the stereoscopic radiographs made of patient in the vertical position, the sternum next to the X-ray plate, care being taken to avoid any rotation of the spine on its long axis. The central focus corresponds to the level of the seventh dorsal vertebra.

We are viewing the thorax through from behind, therefore the right side of the print represents the right side of the thorax. These prints are facsimile reproductions of the original plates.

Note the position and outline of the pericardial shadow. The heart inclines strongly toward the right, its right border extending a greater distance to the right of the midsternal line than does the left border to the left of the spine.

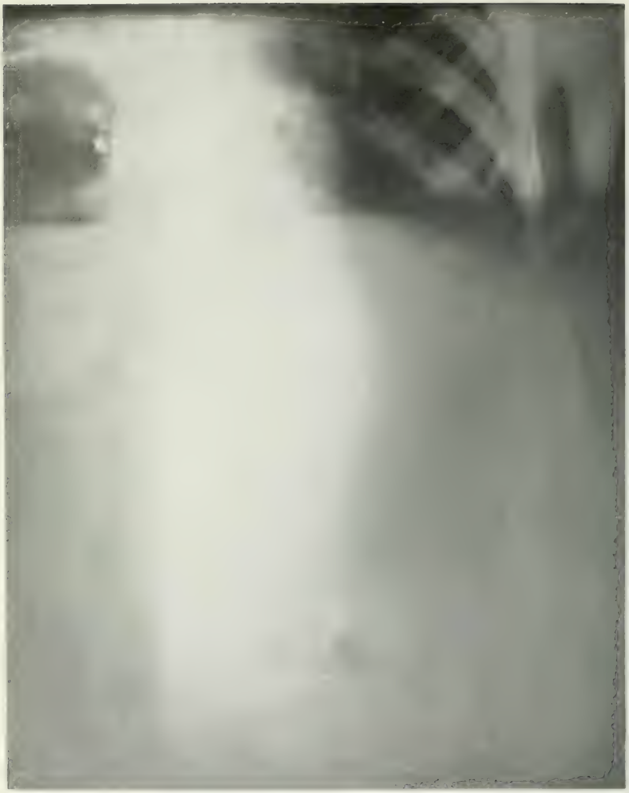
Both hiluses are abnormally dense, the left being markedly enlarged. Both apices are clear, and the pulmonary tissue is normal in all three right lobes and in the upper left lobe.

In the lower portion of the left thorax can be seen clearly a curved white line of greatly increased density. The proximal end of this line is opposite the level of the spinal juncture of the eighth rib on the left side. From this point the line curves outward along the eighth interspace to the ninth rib. Between this line and the upper border of the tenth rib is seen a dark area of greatly decreased density, through which one can clearly distinguish branches from the lower pole of the left hilus. The costal portions of three ribs are also visible. The left margin of the pericardial shadow is not clearly defined.

Note the clear-cut outline of the dome of the diaphragm to the right of the spine and compare it with the faint, indistinct outline on the left of the spine, which is to be seen just below the tenth rib.

The unusual appearance of the lower portion of the left thorax attracted our attention and suggested strongly the probability of a hernia of the diaphragm. A study of the stereoscopic plates supported this suspicion, and it was deemed important to establish the position of the stomach, for it seemed likely that the dark shadow below the abnormally placed curved line was due to gas in the stomach. With this end in view an emulsion of subcarbonate of bismuth and acacia was given the patient by mouth and a second set of plates made immediately, the patient being in the vertical position. (See Fig. 2.)

FIG. 2.

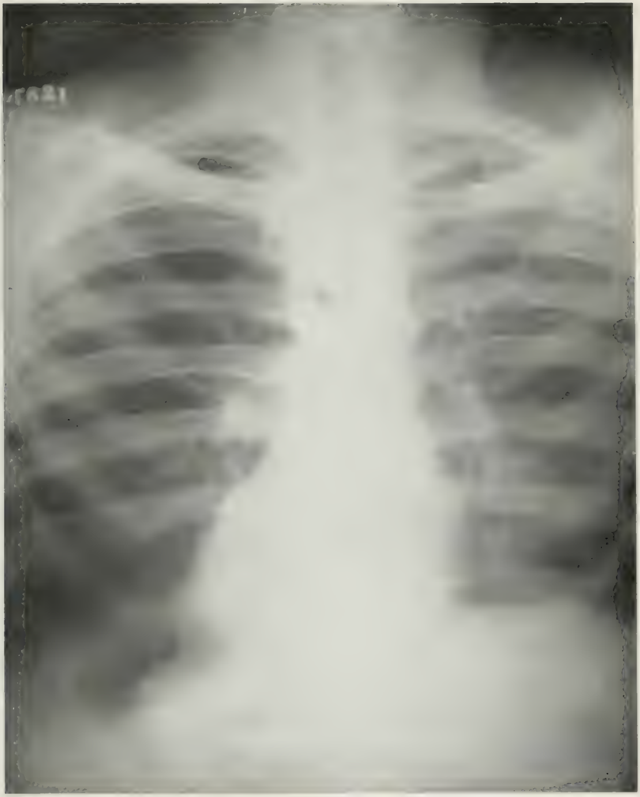


Radiographed immediately after the ingestion of bismuth subcarbonate emulsion. Compare with Fig. 1.

Note the line of demarcation between the white dense area and the dark area lying above it. The white shadow represents bismuth in the stomach, the upper border of the shadow representing the surface level of the emulsion. Above the bismuth is seen the gas bubble of the stomach. This is limited above by the wall of the stomach which we recognize as the curved line described in Fig. 1. Note the faint outline of the bismuth lining the esophagus. This can be traced upward to the limit of the plate. Figs. 1 and 2, together with the history, confirmed the diagnosis of hernia of the diaphragm.

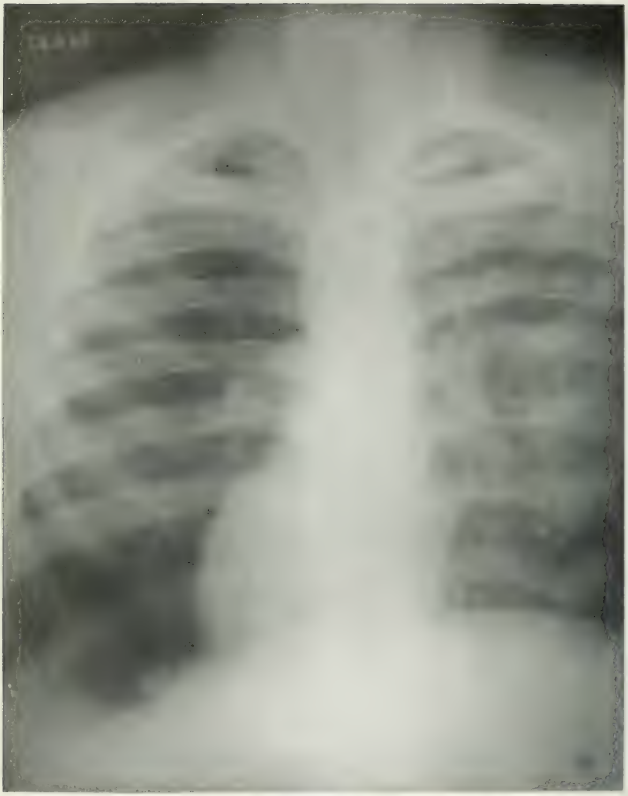
Important diagnostic points demonstrated by the radiographs, Figs. 1 and 2: (1) the presence of a dark circumscribed shadow situated above the indistinct outline of diaphragm on the left side and bounded above by a curved dense band which does not maintain the dome shape typical of the normal diaphragm line, and limited mesially by the left border of the heart which is displaced strongly to the right; (2) the presence of the shadows of the lower branches of the left hilus showing through rarified area; (3) the location of the stomach and its great bubble by bismuth ingestion method.

FIG. 2.



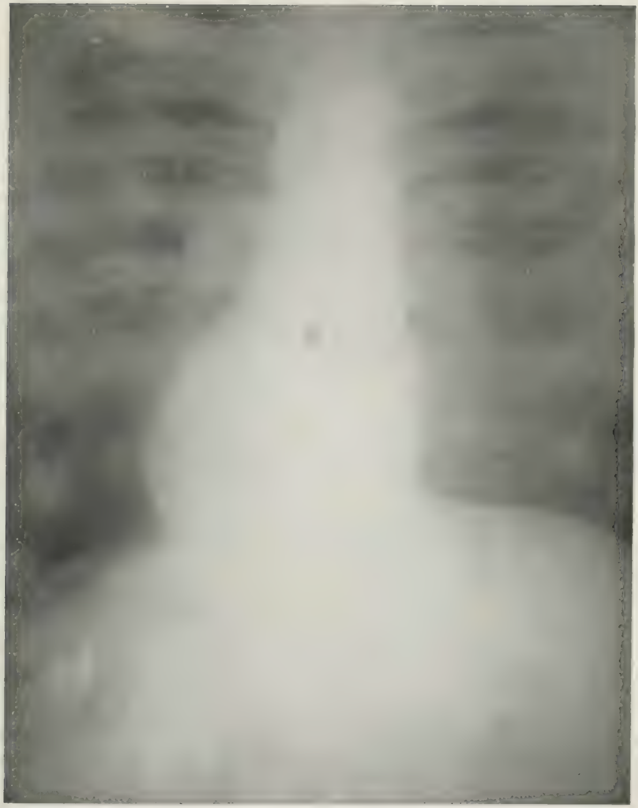
Two weeks after operation Compare with Fig. 1. Patient's pose is the same as in Fig. 1. (1) Note the absence of the curved white line described in Fig. 1; (2) the dense white area just to the left and below the nose of the heart represents the operation scar; (3) the heart has returned almost to its normal position; (4) there is a marked difference in density in the two sides of the chest; the left is darker, indicating a pneumothorax and partial collapse of the pulmonary tissue incident to the operation upon the diaphragm.

Fig. 4



Three weeks after operation. Compare with Figs. 1 and 3. (1) The outline and position of the heart remain the same as in Fig. 3; (2) the shadow of the scar is greatly reduced in size; (3) the shadow of the pneumothorax has greatly decreased; (4) the pulmonary tissue has regained much of its normal appearance. Compare the right and left sides of the thorax.

FIG. 5.



Six and one-half weeks after operation. Compare with Figs. 1, 3, and 5. (1) The heart has returned to the normal position; (2) note the distinct change in the appearance of the scar of the diaphragm; it is much smaller; the outline of the diaphragm upon the left side is more nearly regular than in the preceding plates; (3) practically all trace of pneumothorax has disappeared and the lung tissue has resumed its normal appearance. Compare the left lung with the right

colon be part of the hernia; if this finding be definite it may be regarded as an important point in favor of hernia. Examination after changes in position may furnish some evidence.

In radiograms of either condition the most noticeable abnormality is the existence of a curved shadow line with concavity downward in the left chest, and the problem is to determine whether this shadow line represents stomach wall as in hernia, a high diaphragm as in elevation, or both stomach wall and diaphragm as in elevation. (1) The shadow of elevation generally maintains a typical dome-shape whether it be low or high, or whether the radiograph be taken before or after distention of the stomach with CO_2. The shadow of hernia may vary in outline, may be irregular or incomplete. (2) In diaphragmatic hernia the mottled appearance of lung tissue is visible through the gas contained in the stomach. This is not noted in elevation of the diaphragm even after extreme distention. These two observations are the most important ones in the radiographic differential diagnosis. If two curved shadows be present a radiographic or fluoroscopic examination after distention of the stomach should indicate which line is stomach and which diaphragm; if the lower line be stomach it will move up against the diaphragm line, and the pyloric end of the stomach will then unfold; if the upper line be stomach, distention upward into the chest will be almost unlimited. If the bow line shadow represent both diaphragm and stomach, distention will cause merely the above-mentioned unfolding of the pars pylorica.

The passage of stomach tube or lead bougie with subsequent radiogram does not seem to have yielded much additional information. Estimation of the intragastric pressure during inspiration and expiration in the two conditions has been attempted, but the results are not clear.

A series of X-ray plates following a bismuth meal should add some confirmatory evidence. The stomach may thus be identified as an organ lying in high position. The colon is almost always included in a hernia, and a plate showing bismuth in the colon above the level of the bow line in the chest would be conclusive evidence of a diaphragmatic rupture. As far as I have been able to learn, this point has not been emphasized in the literature, but *a priori* it would seem true.

Fluoroscopic examination is useful in studying the movements of the shadow line. The excursion of the diaphragm line in elevation approaches in character the normal. On the other hand, congenital hypoplasia of the left lung is usually present with elevation of the diaphragm and consequently the movements of the diaphragm line may be far from normal. Indeed, a diaphragm shadow may not move with respiration in elevation and a stomach line may move in hernia. A "paradoxical expiratory displacement" has been noted in diaphragmatic hernia. During forced inspiration the right diaphragm descends normally, while the boundary line in the left chest ascends. During forced expiration the right diaphragm ascends while the boundary line on the left descends. Upon forced expiration by contraction of the abdominal muscles the shadow line on the left is again forced high into the chest. The movements on the left occur a little later than those on the right. This phenomenon has not been described in unilateral elevation in which the movements of the shadow line are likely to approach the normal in character, though they are less free in excursion. (See Becker's article, p. 186 *et seq.*).

The diagnosis then of diaphragmatic hernia from elevation of the diaphragm may, at times, be very difficult and may require all of our technical resources. It is quite likely that *rudimentary elevation* is more common than at present suspected and the condition should be more carefully looked for by clinicians.

The differential diagnosis of *pneumothorax* and diaphragmatic hernia is discussed in articles by LeConte and Ingalls. Particularly may there be difficulty when the pneumothorax is the result of injury. Dyspnœa may be present, and severe pain be experienced. The note over the left chest may be tympanitic, and tinkling sounds be heard. The tympany, however, is likely to extend to the top of the lung, and the breath sounds may be amphoric, vague, faint, or absent. In diaphragmatic hernia breath sounds and vocal fremitus are not generally diminished, and the metallic sounds are associated with peristalsis rather than respiration. The positive coin test is more constant in pneumothorax. Vomiting is likely to be less continuous. Bulging of the interspaces upon closure of the glottis may outline the lower limit of the lung. The radiogram will generally furnish conclusive evidence of an unbroken diaphragm line. Pneumothorax has protean characteristics, however, and diaphragmatic hernia should always be considered before a diagnosis of pneumothorax is made.

Pneumothorax from rupture of the stomach in congenital diaphragmatic hernia with no history of injury has been reported. Such a condition might possibly be suspected after very careful consideration, but it is difficult to see how a diagnosis could be established.

Hydropneumothorax should be less difficult of diagnosis, especially if fluid be present in a moderately large amount. If succussion be obtained, it must be determined that it is produced in the pleura and not in the stomach. A movable line of dulness with signs of pneumothorax and a horizontal fluid line in the radiogram would be conclusive. Leucocytosis and symptoms of pus infection in addition to the findings described above would point to *pyopneumothorax*. Exploratory puncture would be conclusive.

Temporary elevation of the diaphragm has been reported. It has been thought to be the result of an affection of the phrenic nerve. In time the diaphragm line resumes its normal position.

A large cavity in the lower lobe may give metallic sounds and dyspnœic symptoms. The cavity may develop suddenly after the expectoration of large amounts of sputum. The radiogram would show evidence of lung involvement elsewhere, and it should be possible to recognize the diaphragm line.

The name *subdiaphragmatic pyopneumothorax* has been given to the condition in which a pus cavity beneath the diaphragm contains gas. The most common cause is perforating ulcer of the stomach or duodenum. The diaphragm may be elevated as high as the third rib. There may be tympanitic resonance over the area of the cavity. Metallic tinkle, succussion splash, and coin sound may be present. The chief difficulty would be in differentiation from pyopneumothorax. A history pointing to pre-existent abdominal disease and radiographic findings of elevation of the diaphragm should differentiate the condition.

In the case reported herewith, recurrent colic would have suggested *gall-bladder disease* or other abdominal lesion had a history of trauma not been obtained or had the findings on physical examination of the left thorax been less definite.

Pyloric stenosis has occurred from mechanical conditions in congenital diaphragmatic hernia, and the predominance of gastric symptoms has led to a suspicion of *ulcer*. *Œsophageal stenosis* may be caused by acute hernia.

Four cases of diaphragmatic hernia have been operated upon at St. Mary's Hospital (Mayo Clinic). Three of these were reported in 1909 by Beckman. The case seen since then was diagnosed from the history and clinical findings by the writer and independently from a study of the radiograms by Selby.

L. J. (a55100), male, aged twenty years. Consultation June 26, 1911. Patient had been caught, together with four other men, two of whom were killed, in a sand slide one year previously; he was instantly and forcibly doubled up with his head between his feet, was unconscious for five to ten minutes, but easily revived. The stomach was empty at the time of the accident. He experienced no pain for a half hour after the injury. Then pain over the entire abdomen and chest became severe; shortness of breath was a prominent symptom, complaint gradually localizing to the upper abdomen and left side of chest and continuing together with some shortness of breath for two weeks. The patient remained in bed for five weeks. Pain across the lumbar region was also complained of, and the patient could not draw his legs up as he lay in bed for two weeks. Bladder and bowel control was good. He was able to walk in ten weeks. After this at times he complained of "sticking" pains across the abdomen and in the left side of the chest, and a sensation of the "stomach being lifted up under the chest." During the year which elapsed between the time of injury and the examination, the patient had had attacks of severe epigastric pain lasting for an hour or two, with much bloating, sour eructation, and nausea, but no vomiting nor symptoms of intestinal obstruction. Pain often began in the right lower abdomen and later localized in the upper abdomen and left side of the chest. Soda gave some relief, but food did not. These attacks came at any time without relation to food and recurred every few weeks. There had been ten pounds loss of weight. Because of these attacks he consulted a physician. The family history and personal history were negative.

On physical examination a dull tympany was noted over the left side of the chest downward from the level of the sixth spine behind and anteriorly to the midaxillary line. Expansion did not seem to be markedly affected. Vocal fremitus was present over this area, though slightly diminished. The breath sounds could be heard, but were quite distant. Tinkling sounds could also be heard, and these were close to the ear and seemed to occur with peristalsis. Anteriorly from the midaxillary line the percussion note was quite dull, so that the left border of the heart could not be outlined. Heart dulness, however, extended three inches to the right of the midsternal line. Above the second rib in front and the spine of the scapula behind the percussion note was hyper-resonant and breath sounds harsh. The right lung seemed normal.

The X-ray prints, together with their descriptions, by J. H. Selby, will explain the condition found. It is necessary only to point out that the diagnosis from the radiograms was made chiefly from (1) the fact that the bow line in the left chest did not conform in outline to the dome shape maintained in elevation of the diaphragm, and was irregular and indefinite, particularly at its outer portion; and (2) the fact that lung tissue could be seen through the gas bubble below this line, which is not observed in elevation.

Operation July 5, 1911: An oval-shaped opening in the left half of the diaphragm, near the crux, large enough to admit the hand easily, was found. The hernia contained stomach, large intestine, spleen, small intestine, and the tail of the pancreas. (The presence of spleen probably explains the dulness found anteriorly on percussion of the chest.) The lung was completely collapsed. The stomach was distended and its walls were hypertrophied, doubtless as the result of mechanical obstruction. Nearly all of the transverse colon and 12 feet of the jejunum were in the chest. The spleen was twice the normal size and most difficult to reduce. It was torn and required catgut sutures. Tremendous traction was exerted by the chest cavity so that the stomach and spleen showed a marked tendency to be drawn back into it. The opening into the pleural cavity was sutured with heavy linen for three or four stitches, then interrupted sutures were placed. The suture line was five inches long. The posterior margin of the opening was difficult to catch, the anterior quite easy. Additional sutures were placed where there was evidence of air aspiration along the suture line.

It is impossible to determine what portion of the abdominal contents became a part of the hernia as the result of opening the abdomen. In view of the evidence of decided negative pressure in the chest upon the attempt at reduction of the hernia, it seems likely that the original hernia was increased in size by the additional pressure from below. The lung was found more nearly collapsed at operation than one would have expected from the extent of visible lung tissue in the radiograms.

Four days after operation the patient was quite comfortable and easily examined. The temperature was nearly normal. There were no signs of fluid. Over almost the entire left chest the percussion note was exceedingly resonant, tympanitic, and so drum-like that it approached the quality of a musical tone. Vocal fremitus could be felt with difficulty and breath sounds were distantly transmitted. The heart remained displaced. A pneumothorax was evidently present. One week later there was some change in the percussion note. It continued, however, to be drum-like and very resonant. Breath sounds could be heard a little closer to the ear save at the extreme left base. Cardiac dulness was almost normal in outline. The patient left the hospital on the thirteenth day. He was examined repeatedly up to the time of his discharge six and one-half weeks after operation. No complications developed. The lower portion of the lung slowly completed its expansion. An X-ray plate taken six and one-half weeks after operation is reproduced. This shows almost completed expansion of lung tissue. The return to the normal is remarkable, when one considers that the lung had been partially collapsed for one year. The patient is at present enjoying excellent health.

On recapitulation then it is seen that a history of severe trauma, followed by upper abdominal and left thoracic pains.

dyspnœa, and vomiting, together with physical findings pointing to displacement of the stomach or intestine into the lower left chest and of the heart to the right, will ordinarily be sufficient for making a diagnosis of diaphragmatic hernia. If the history and findings be definite, this will be true whether the patient is seen immediately after injury or some time later. Röntgen ray findings will then be mostly of corroborative value. When, however, the injury has been less severe and the symptoms and signs less definite, and again in most cases of congenital diaphragmatic hernia, radiographic and fluoroscopic examinations must be relied upon for a differentiation of the condition. In interpreting the plates (1) a destruction of the definite dome shape characteristic of the normal diaphragm line, (2) the appearance of lung tissue through the gas bubble in the left chest, and (3) the demonstration of bismuth in the colon above the level of the bow line of the chest constitute the most important evidence in favor of hernia of the diaphragm. By fluoroscopic examination the "paradoxical respiratory phenomenon" may be demonstrated.

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[1] The writer has collected a bibliography of 187 references. This will be furnished to any one particularly interested in a study of the condition.

MANAGEMENT OF THE OPENING IN THE TRANSVERSE MESOCOLON IN COMPLETING THE OPERATION FOR POSTERIOR GASTROJEJUNOSTOMY.

BY WILLIAM J. MAYO, M.D.,

OF ROCHESTER, MINNESOTA.

THE opening made in the transverse mesocolon through which the stomach is brought out posteriorly in the operation of gastrojejunostomy was originally closed by fastening the torn margins with several sutures to the posterior wall of the stomach at some little distance (one-half to one inch) from the gastro-intestinal anastomosis. Later these sutures were omitted because they were thought to be unnecessary. In our experience the omission proved to be unfortunate, since in one case six feet of small intestine herniated through the opening into the lesser cavity of the peritoneum, and on the twelfth day a second operation was required for the relief of intestinal obstruction.

It has been advised by some authorities to suture the margins of the opening to the jejunum just beyond the gastro-intestinal anastomosis, and this plan is practised by a few careful surgeons, although several cases of obstruction have been reported as resulting from it. For some years[1] when performing this operation we have turned the margins of the opening underneath and sutured the peritoneum of the lower surface with three or four stitches to the suture line which unites the stomach and jejunum. This technic has proved very satisfactory in our cases. However, we have had two cases in which a fat transverse mesocolon, sutured in this way, caused secondary trouble because of adhesions forming in a collar-like mass around the stoma, and cure was not obtained in either case until a second operation was performed

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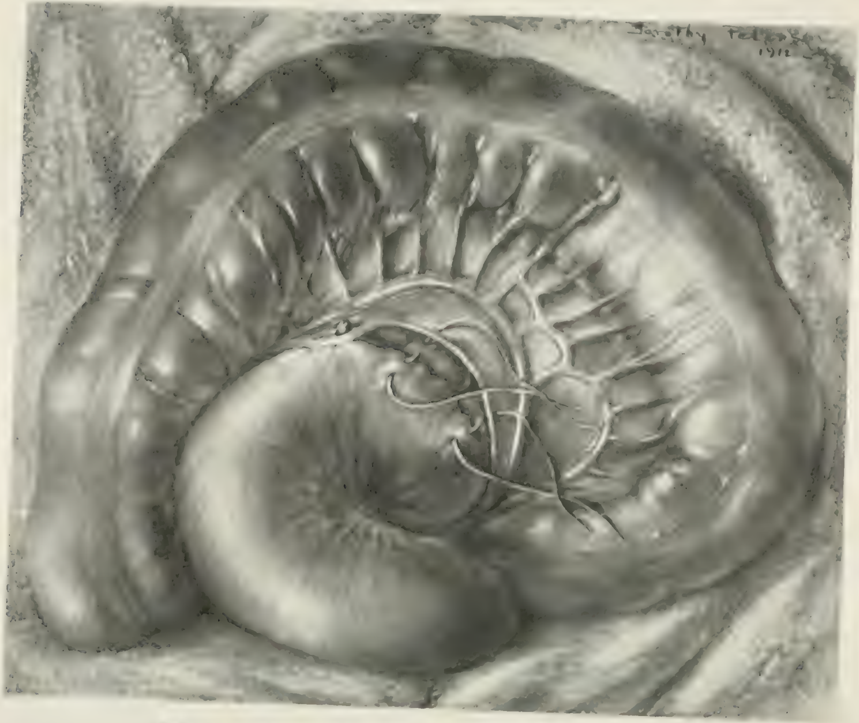
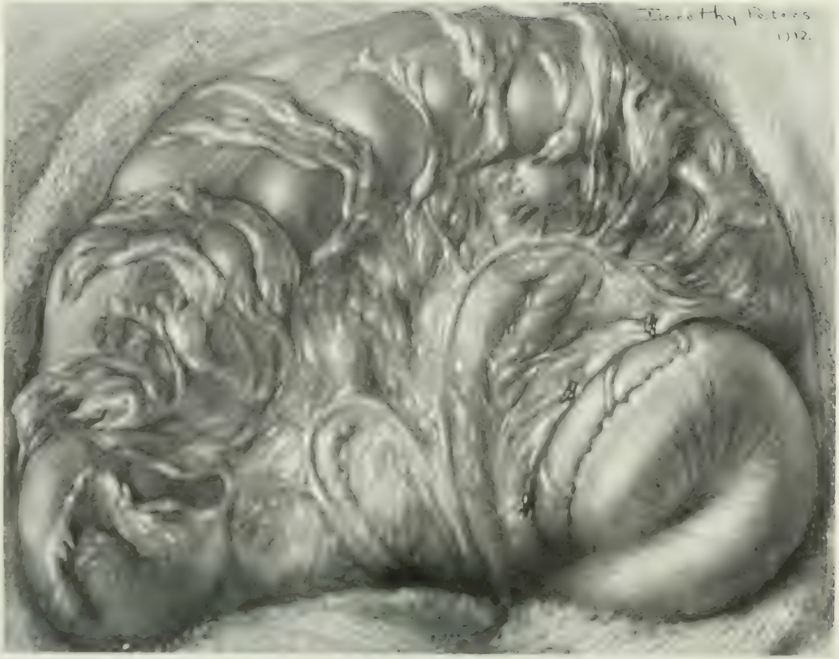
[1] Mayo: ANNALS OF SURGERY, November, 1905.

Fig. 1.



Thin transverse mesocolon sutured to the suture line in gastrojejunostomy.

FIG. 6.



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in which the margins of the transverse mesocolon were dissected free and united to the stomach at a distance of an inch from the suture line of the gastrojejunostomy.

Fastening the margins of the opening in the transverse mesocolon to the gastrojejunal suture line by several sutures and neatly tucking the edges underneath so there will be no raw surface to become adherent (Fig. 1) is an excellent practice and suitable in the large majority of cases. In the occasional case, however, in which the transverse mesocolon is quite fat, there is danger that adhesions will form, and this technic should not be adopted in these cases, but rather the old method of suturing to the posterior wall of the stomach three-fourths of an inch away from the gastro-intestinal anastomosing suture line (Fig. 2).

SARCOMA OF THE SMALL INTESTINE.

BY JOHN DOUGLAS, M.D.,

OF NEW YORK

Visiting Surgeon, Bellevue Hospital; Assistant Surgeon, St. Luke's Hospital.

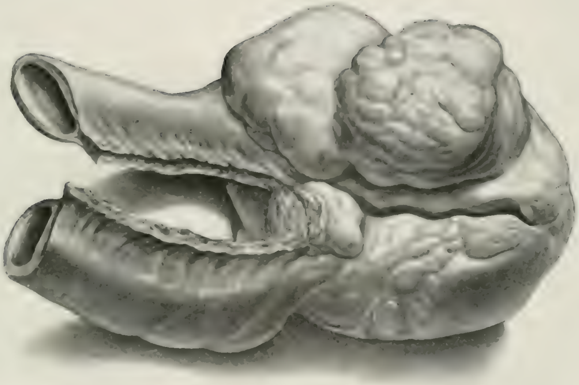
MALIGNANT growths of the large intestine are unfortunately comparatively common, carcinoma being the type of growth in the vast majority of cases, Mayo,[1] in a report of 100 resections of the large intestine, 61 for malignancy, only reporting one case of sarcoma. In the small intestine malignant growths are less frequent, and sarcoma in its various forms is by far the most usual type of growth. Kanzler[2] in 1906 could only find 23 published cases of carcinoma of the jejunum or ileum, to which he added two of his own. Primary sarcoma of the small intestine, however, is sufficiently unusual to make the following case worthy of report.

M. C., male, age twenty, native of Turkey. His family and previous history were negative. Six weeks before his admission to Bellevue Hospital on July 1, 1911, he noticed a mass in the lower part of the abdomen. It gave him an uncomfortable feeling when he was up and about, but the pain disappeared on lying down. Tumor grew larger and pain became worse, and he was obliged to stop work three days before admission to the hospital, because of weakness and discomfort. No urinary symptoms.

Physical examination showed a well-developed, anæmic looking but not emaciated patient. The abdomen was somewhat distended but not rigid, and there was no evidence of free fluid. In the median line and slightly to the right of it, midway between the umbilicus and the symphysis pubis, could be felt a firm mass about the size of the fist. It was somewhat irregular in outline and very slightly movable.

A median abdominal incision 12 cm. long was made over the mass, and on opening the peritoneum, an irregular white tumor involving a coil of the ileum and the glands in the mesen-

FIG. 1



Sarcoma of small intestine, showing specimen removed at operation.

tery of the intestine at this situation was demonstrated. The tumor was adherent to the omentum and slightly to the peritoneal coat of the bladder, and in attempting to free and deliver the mass, the lumen of the intestine, the wall of which was apparently replaced by tumor tissue, was broken into. The tumor with at least 5 cm. of normal intestine on each side of the growth, in all about 45 cm., was resected and a lateral anastomosis performed. The wound was closed without drainage. The bowels moved without catharsis or enemata the day following operation, and except for a slight infection in the lower angle of the wound, due probably to contamination when the intestine was broken into, convalescence was uneventful. In the three months following the operation the patient had gained 22 pounds in weight. The pathological report showed lymphosarcoma.

The most complete report and analysis of cases of sarcoma of the small intestine are those of Moynihan,[3] who gives brief reports of 40 cases submitted to operation up to 1906; and of Lecène[4] (1907), whose article is the most exhaustive on the subject, and includes an analysis of 89 cases, both operative and non-operative. Since these statistics have been assembled, additional cases have been reported by Barling,[5] McGlinn,[6] Erdmann,[7] Anderson,[8] Stern,[9] and Goebel,[10] each one case, while Bondareff[11] reports two cases, LeRoy[12] reports three cases, one a case in which resection was performed, one case found at autopsy, and one occurring in a tuberculous woman. Munk[13] reports six cases of sarcoma of the small intestine and one of the splenic flexure from the Breslau clinic between 1900 and 1908. In addition to these cases reported as sarcoma Fletcher[14] reports a case of primary lymphadenoma and Scudder[15] one of malignant lymphoma or lymphosarcoma of the small intestine for which resections were performed.

Pathology.—Round-cell sarcoma occurs in about half the total number of cases reported, spindle-cell and lymphosarcoma are the next most frequent varieties, while myosarcoma, alveolar sarcoma, fibrosarcoma, giant-cell sarcoma, myxosarcoma, and angiosarcoma are also reported. Lecène divides the cases into two kinds, circumscribed and diffuse, single tumors occurring twice as frequently as multiple growths. Ulceration occurs in over half the cases, but cicatricial contraction, such as occurs in carcinoma of the intestine, causing stenosis and obstruction, is very unusual. The ileum is the most frequent site of the tumor, the jejunum, ileocæcal region, and junction of the duodenum and jejunum being involved in the frequency of the order given. The mesenteric glands are involved early in the course of the disease. Perforation of the intestine may occur.

Symptoms.—The first symptom noticed is usually the presence of the tumor in the abdomen or abdominal pains or discomfort. There may be some abdominal distention, but complete obstruction is rare. When obstruction occurs it is usually due to growths in the mesentery or to kinks or adhesions of the intestine. A small tumor may be the cause of an intussusception, which latter condition is not infrequently the first symptom of the growth. Anæmia and cachexia appear quite early, the latter being the usual cause of death. Ascites or malena is rare. There may be some elevation of temperature, but usually not.

Prognosis.—Of course without operation the prognosis is fatal. Lecène gives as the duration of illness four to six months in round-cell and lymphosarcoma; and eight to ten months in spindle-cell sarcoma. The primary mortality from operation is high—57 per cent. in Moynihan's series of 40 cases, five deaths being due to recurrence. The recorded cases since these statistics would lower this mortality. Bondareff states that recurrence occurs in 95 per cent. of the cases of round-cell sarcoma, although he reports one case without recurrence for three years, and Steinthal [16] one free for three and a half years, and a case of spindle-cell sarcoma free for four years after operation.

Statistics, however, as to operative mortality or frequency of recurrence are of little value, as so many elements, such as size, distribution, situation, duration, glandular involvement, and involvement of neighboring structures, are the determining factors.

Treatment.—If the diagnosis is made early enough to completely remove the growth there is some prospect of a cure, but even if there is prospect of recurrence, the symptoms may be relieved and life prolonged by as complete a resection as possible, well clear of the involved intestine, with the removal of the mesentery and glands, followed by an anastomosis either by the end-to-end or lateral method.

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INVERSION OF MECKEL'S DIVERTICULUM.

WITH A REPORT OF SIX CASES.

BY HAMILTON DRUMMOND, M.B.,
OF NEWCASTLE-ON-TYNE,
Surgical Registrar, Royal Victoria Infirmary of Newcastle.

Of 78 cases of intussusception of all ages operated upon in the Royal Victoria Infirmary, Newcastle-upon-Tyne, from 1900 to February, 1911, five (6.4 per cent.) were due to inverted Meckel's diverticulum. The notes of these cases, along with one other which occurred in the practice of Dr. Modlin in Monkwearmouth Hospital, form an interesting addition to the already published records.

Gray,[1] with a case of his own, collected 40 cases, and it is now generally recognized that the condition is more common than was formerly supposed.

At the Summer Pathological Meeting of the Northern Division of the British Medical Association, 1910, I showed a series of Meckel's diverticula, some removed by operation and others found in the post-mortem room, and called attention to the different types met with and to the dangers attending their presence. For example, a persistent Meckel adherent to the umbilicus by a cord may either give rise to a secondary volvulus of the loop of small intestine from which it arises, or, acting as a band, may produce intestinal obstruction. Again, a Meckel of unusual length (6 in. or 8 in.) rarely exists throughout life without becoming adherent to some point in the intestinal tract and thus exposing the individual to obstruction or strangulation. Several cases of the kind have come under my own notice, and in some a persistent Meckel's diverticulum was found to be the seat of an acute inflammation which gave rise to gangrene.

The clinical picture in the cases where the intestinal obstruction is not marked may closely simulate that of acute appendicitis, with or without abscess; and where the mass or tenderness is not in the appendix area, an acute Meckel's diverticulitis should always be taken into consideration in the diagnosis.

A Meckel's diverticulum with a narrow neck may encourage and harbor calculi which give rise to attacks of pain like gall-stones or appendicitis, the pain being due to the forcible contraction of the unstriped muscular tissue in the diverticulum in its effort to expel the calculi, as in a case reported by Sherren.[2] Here a fold of mucous membrane narrowed the lumen near the proximal end of the diverticulum, which was packed with calculi. In this case a diagnosis of appendicitis was made.

A case was recently reported by Albert Martin[3] where a Meckel's diverticulum with a narrow neck contained a calculus the size of a horse bean. The end of the diverticulum was completely gangrenous and lay in an abscess cavity. There was also definite intestinal obstruction.

Another rare pathological entity arising from the remnants of the umbilical duct is referred to by Eisendrath.[4] There is neither a communication with the bowel nor at the distal end with the umbilicus, but the intermediate portion, as a result of its own pent-up secretion, forms an enterocyst which may give rise to a large tumor analogous to a hydrops of the gall-bladder due to a calculus impacted in the cystic duct.

A small Meckel's diverticulum unattached at its peripheral end, with a broad base and a narrow apex, is the type most likely to become inverted into the intestine and cause intussusception of the ileum, and it is to this type that I wish specially to draw attention.

Case I.—P. M., a boy aged five years, was admitted to the Royal Infirmary, Newcastle-upon-Tyne, on June 6, 1901, under the care of Prof. Rutherford Morison. He was perfectly well until the previous day, when he was seized while at school with severe pain in the abdomen and shortly afterward vomited. On reaching home the bowels moved, but the pain persisted and came on in spasms every few minutes. He passed blood by the rectum and during the evening the spasms became less frequent and he occasionally slept. Vomiting persisted up to the time of his admission.

On the following day when admitted to the hospital his general condition was good. A sausage-shaped tumor could be felt in the right iliac fossa, but nothing abnormal by the rectum.

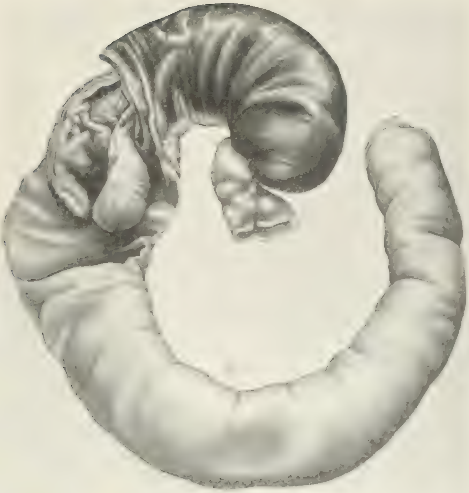
Professor Morison opened the abdomen over the tumor by a small oblique muscle-cutting incision in the right iliac fossa, and clear free fluid escaped. An intussusception (about 6 in. in length) involving the small bowel only was delivered, and reduction was effected without much difficulty. When this had been done a hole in the side of the gut was noticed, and something firm, subsequently found to be an inverted Meckel's diverticulum, was felt in the bowel just beyond this point. A small incision was then made at the margin of the Meckel in the long axis of the bowel and the diverticulum was everted. It was then excised and the wound in the ileum sutured transversely by Lembert sutures and the abdomen closed in layers of catgut. The wound was found to be healed on the ninth day after operation, when the skin sutures of silkworm gut were removed; the patient caused no anxiety after operation.

The specimen is a small Meckel's diverticulum which in the recent state was 1½ inches in length and cone-shaped, with the broad end toward the bowel.

Case II.—E. S., a youth aged fifteen, was admitted to the Monkwearmouth Hospital under the care of Dr. Modlin on July 6, 1904. While going about four days previously he had an attack of pain in the lower part of the abdomen. Shortly afterward he vomited and continued to be sick throughout the day.

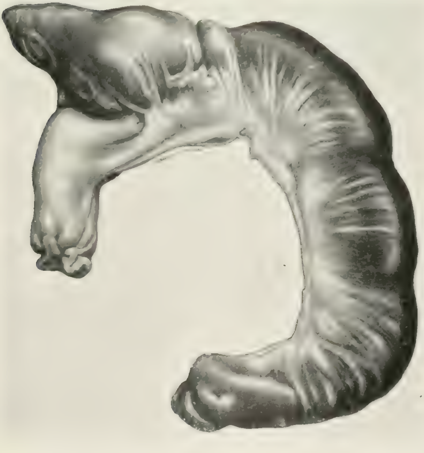
On the following day he felt better and the bowels were moved, but at 7 P.M. he was again seized with severe pain and vomiting, which persisted until next morning, when he again had relief which continued until early in the morning of the day of admission. About 2 A.M. of that day the pain returned and persisted up to 6 A.M. On admission, about 8 A.M., he looked ill and complained of slight pain about the umbilicus. There was slight distention of the abdomen. No tumor was palpable, but he was more tender on the left side than on the right; there was no dulness in the flanks.

Fig. 1.



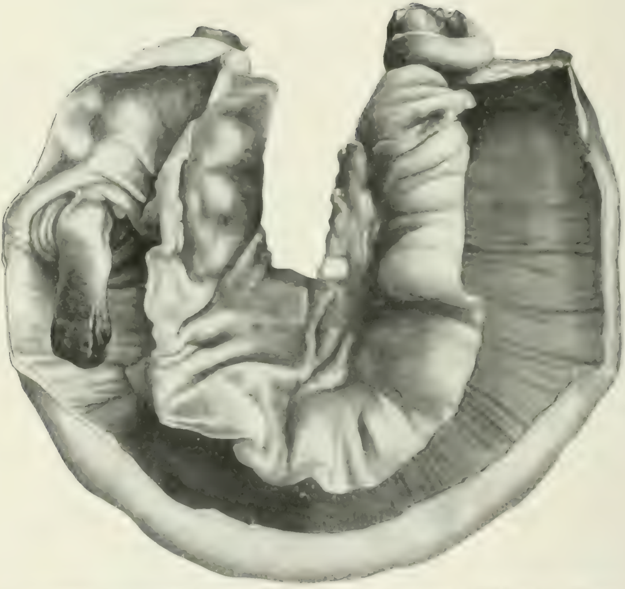
Meckel's diverticulum forming the apex of the intussusception.

Fig. 2.



The Meckel's diverticulum and intussusception are seen reduced.

FIG. 3.



The intussusception has been reduced but the Meckel's diverticulum is still lying [illegible]

An enema given shortly after was without effect.

On opening the abdomen Dr. Modlin found an intussusception of small bowel into small bowel lying to the left side of the umbilicus. Attempts at reduction were of no avail as the layers of gut were so adherent, and a resection was done with end-to-end anastomosis. The patient died shortly afterward.

The specimen (Fig. 1), which had been hardened in formalin, was on examination found to consist (without reduction of the intussusception) of 22 inches of small intestine; and on removal of the bowel over the apex of the intussusception, the distal end of an inverted Meckel's diverticulum was seen. The diverticulum and the ensheathing layer of small intestine surrounding it were completely gangrenous and the œdematous mucous membrane stripped readily from its walls. The length of the diverticulum was 4½ inches; it was distended at both ends and narrow in the intermediate portion.

Case III.—C. S., a man aged twenty-five, a bricklayer, was admitted into the Royal Victoria Infirmary, Newcastle-upon-Tyne, under the care of Mr. Angus on November 21, 1908, with the history that on the morning of November 18 (three days before), while at work, he was seized with a severe pain in his belly after taking a drink of water. With the desire to defecate, his bowels were well moved, and about one hour later he vomited. The pain persisted and he continued to vomit at intervals up to the time of admission. The day before admission the pain came on intermittently and was accompanied by rumblings.

He stated that he had suffered from attacks of abdominal pain a few months previously which were always relieved when his bowels were moved.

On admission he looked ill; the pulse was 40, temperature 97.6°, respirations 80; his tongue was dry and he was vomiting dark, bile-stained fluid. He stated he had not had his bowels moved the first day of his illness and had not passed flatus.

The abdomen was not distended but rather slightly retracted. The whole wall was somewhat rigid and there was tenderness on pressure in the epigastrium.

A diagnosis of intestinal obstruction involving the small intestine was made and immediate operative interference was decided upon.

Mr. Angus opened the abdomen by a vertical incision in the middle line reaching above and below the umbilicus. The small intestines were acutely congested and distended, and protruded into the wound. An intussusception, almost gangrenous, lay close to the cæcum. Attempts to reduce the bowel were unsuccessful, so the gut was resected, the ends being closed and a lateral anastomosis made between the small intestine and cæcum with a Murphy button. The abdomen was closed in layers of chromic gut and silkworm sutures for skin.

The patient bore the operation well and made an uninterrupted recovery. The button was passed on the seventh day after operation and he left the hospital healed and well on December 11, 1908.

Specimen shows about 6 inches of intestine without reduction of the intussusception, the apex of which is formed by Meckel's diverticulum. On reduction there is altogether about 12 inches of the bowel.

The Meckel was plum-colored and showed commencing gangrene most marked at its terminal end. The whole was completely inverted into the bowel and on reduction was about 4 inches in length.

Case IV.—E. W., aged eleven, schoolboy, was admitted into Prof. Rutherford Morison's clinic in the Royal Victoria Infirmary on the evening of March 12, 1909. It was stated that he went to bed quite well three days before admission, but shortly after complained of sudden pain in the epigastrium and later vomited. The vomiting continued right up to the time of admission. The bowels had not been moved for two days.

On admission he looked very ill, his temperature was 128°, and his tongue was dry. His peripheral circulation was extremely bad.

The abdomen was markedly distended, tympanitic, and tender.

Rectal examination discovered a tumor in front of the rectum, which appeared to be fixed in the pelvis. There was no note of blood on the finger.

About one hour after admission Mr. Richardson opened the abdomen in the middle line below the umbilicus. Some free fluid was present in the peritoneal cavity. The small intestine was much distended and red. The pelvis was filled by an intussusception of small intestine into small intestine. The mass was gangrenous and irreducible and was about 7 inches in length.

The bowel was resected and a lateral anastomosis by simple suture performed.

After reducing the eviscerated intestine into the abdomen. the belly was closed in layers. The boy stood the operation badly and died shortly afterward.

In this case a definite intucking of the umbilicus was observed, but not until after death.

The specimen showed a gangrenous intussusception which, when reduced, measured 18 inches in length. Forming the apex was a small Meckel's diverticulum in the recent state about 1½ inches in length, which had become completely inverted into the lumen of the bowel, and it, like the surrounding intestine, was completely gangrenous. The diverticulum sprang from the anti-mesenteric border and was distinctly cone-shaped, with the broad end forming its base.

Description of Specimen (Fig. 2).—The intussusception, which was reduced and everted prior to hardening in formalin, consisted of a loop of small intestine measuring 18 inches in length. The first 3 inches were normal in size and color, but directly below this point from the origin of the diverticulum the bowel was distended, œdematous, and plum-colored for 12 inches. The gangrene was most marked around the diverticulum, the terminal 6 inches gradually being more normal in appearance. The gangrenous Meckel's diverticulum sprang from the anti-mesenteric border. It measured 1½ inches in length and, as will be seen from the accompanying drawing, was distinctly cone-shaped with the broad base toward the bowel; the circumference of the base was 2¾ inches. It was inverted into the bowel.

The peritoneal coat of the involved bowel was extensively ruptured on both sides, and the muscular fibres were plainly seen where the serous membrane had given way. No sign of any mesentery or vessels running from the bowel to the diverticulum were seen, the latter probably being rendered invisible by the œdematous condition of the peritoneal coat.

On inspection of the diverticulum from within, the broad base was found to be nearly occluded by œdematous mucosa which had become separated throughout nearly the whole of its length, the only firmly attached portion being that in relation with its apex. The small intestine immediately above the diverticulum showed a well-marked fold of mucous membrane extending round the greater part of the lumen of the bowel not unlike a valve of Houston in the rectum. A similar condition was found in Case VI.

Case V.—W. J., aged three, female, was admitted under the care of Mr. Martin in the Royal Victoria Infirmary on November 9, 1910.

The present attack began one week previously. While playing two hours after breakfast she was seized suddenly with a severe pain in the abdomen about the umbilicus and vomited shortly afterward. She remained in bed for three days, refusing any solid food and complaining of pain in the stomach. On the following day she became much worse. The pain came on in paroxysms and the vomiting continued up to the time of admission. The bowels were slightly moved at the commencement of the illness, but during the last two days prior to admission no flatus or fæces had been passed.

The mother stated that the patient had previously had similar attacks, which were always relieved by emptying the lower bowel with simple enemata and a dose of castor oil by the mouth.

The first attack was noticed in January, 1910, and they had persisted right up to the time of admission, coming on about every six weeks. The pain was said to be cramping in character and at times most severe, causing her to cry out. She had never passed blood per rectum. As a rule the attacks came on after she had gone to bed.

On admission, the child was well nourished but looked ill and in a lethargic condition. Pulse 126; temperature 99.8°; tongue dry and brown.

Abdomen: There was some distention in the upper part. Marked peristaltic movements were plainly seen in the region of the umbilicus on the right side.

The umbilicus itself was distinctly indrawn.

There was no rigidity of either rectus muscle and no tumor could be felt.

A rectal examination gave no further information. There was no blood on the examiner's finger.

Operation: Mr. Martin opened the abdomen in the middle line above the umbilicus. Distended loops of small intestine protruded into the wound, and on pushing these aside a tumor was found in the right hypochondriac region. On further examination this was found to be an intussusception, the apex of which reached as far as the middle of the transverse colon. It was easily reduced, and the bowel was in good condition except at one point where an inverted diverticulum arose from the antimesenteric border of the gut and formed the apex of the intussusception.

The diverticulum was reduced and excised, and the hole in the intestine was closed by a purse-string suture of silk and the abdomen was closed in layers of catgut. The child died twelve hours after the operation.

An examination of the specimen, which in the recent state was 1¼ inches in length, showed it to be cone-shaped with the broad end toward the bowel. The apex of the diverticulum contained a tumor, the size of a small hazel-nut, which on section proved to be an accessory pancreas. Section of the bowel wall at the base of the diverticulum when microscoped showed that it contained all the intestinal coats.

Case VI.—Wm. L., aged twenty-nine, married, a brass polisher, was admitted into the Royal Victoria Infirmary in July, 1909, for hæmoptysis. After a short stay in the hospital he left for the seaside, but soon returned under the care of Mr. Angus, complaining of colicky pains in the abdomen. The griping pain was sometimes very severe and extended from the epigastrium over to the left hypochondriac region.

He went back to work in August, 1909, and except for the griping pains remained in good health until November, 1910.

On December 3 of that year he was readmitted with a recurrence of hæmoptysis, having had two attacks within three weeks.

On admission, he was a well-nourished, healthy-looking man. Temperature normal, pulse 88, and tongue clean. He stated that his bowels were usually constipated and that he required frequent purgatives.

Examination of the chest showed signs of early mischief below the left clavicle. The abdomen was normal.

On December 26 and 28 he had hæmoptysis and on December 31 he had an attack of abdominal pain and was observed to be slightly tender and distended in the epigastrium. The hæmoptysis recurred again on January 10 and January 19.

On January 25, while in bed, he complained of cramping pains in the abdomen and felt very ill. He vomited incessantly until 3 A.M. on the following day, when blood was noticed in the vomit. Shortly after the bowels were moved by enema and he felt much better.

On February 4, after tea, he was again seized with a sudden pain in the epigastrium, which made him vomit and roll about. On examination, a mass, which increased in size and became harder when he complained of pain, was felt in the lower part of the abdomen. The bowels were moved and he passed about one pint of bright red blood per rectum.

As his condition did not improve, Mr. Angus opened the abdomen by a median laparotomy on February 6. In the right lower abdomen was found an intussusception of the enteric type, the lower end of which was about 4 inches from the ileocæcal valve. On attempting to reduce the intussusception the bowel wall was split in several places through its peritoneal coat, otherwise the reduction was completed without difficulty. There was some free fluid present.

On palpating the bowel which had intussuscepted a lump was felt within the lumen running from a puckered depression on the anti-mesenteric border of the ileum. The loop of bowel was therefore resected, the ends being closed by Lembert sutures of linen thread, while a lateral anastomosis was performed by simple suture, and the abdomen was closed in layers by catgut.

Patient stood the operation well and continued in a satisfactory condition until February 11, when he complained of a sudden pain in the right side, which was followed shortly after by vomiting.

On the following day his abdomen was much distended, the pain continued in spasms, his pulse became rapid and small, and he died on February 14, 1911.

Post-mortem examination showed peritonitis limited to the lower abdomen. The anastomosis which was situated about 18 inches from the cæcum was perfectly united, but it was found that a leak had occurred in the free end of the distal closed loop of intestine where a gangrenous patch had perforated from deficient blood supply.

Description of the Specimen.—The resected intestine in the recent state was about 2 feet 6 inches in length (Fig. 3). It showed some dilatation and hypertrophy of its walls, and about the middle of the loop, close to the mesenteric border and extending on to the greater part of the mesentery, was an area of subperitoneal extravasation. The serous coat of the bowel was thickened and had ruptured during the act of reduction at a point adjacent to the extravasation, and it was here that the intestine wall had been sutured.

Apart from this, the specimen showed that neither the mesentery nor the bowel wall was seriously damaged.

The Meckel's diverticulum, which measured 3½ inches in length, is seen in the drawing (the intussusception of the bowel having been reduced). It was slightly club-shaped toward the distal half, which was fuller and measured 2 inches in circumference.

Immediately above the base of the Meckel's diverticulum the mucosa formed a distinct fold which appeared to diminish the size of the lumen of the bowel at this point.

The distal third of the diverticulum showed commencing gangrene, being of a dull plum color, while the remainder looked normal.

Viewed from the peritoneal aspect a portion of well-formed mesentery, in which the vessels were obvious, could be seen protruding from the opening at the point of entrance of the inverted diverticulum; this (mesentery of the Meckel) was continuous with the mesentery of the small bowel.

The entrance of the inverted Meckel easily admitted a fine probe which passed close up to the apex of the diverticulum.

REMARKS.—It should be mentioned that for a Meckel's diverticulum to become completely inverted into the bowel it must be free in the belly cavity. But this is not always the case, as adhesions, which fix the diverticulum to the adjacent small intestine, are apt to form, as is not infrequently found at post-mortem examinations. They naturally prevent inversion taking place and diminish the risks suggested by these cases.

It will be noted that in all six cases here recorded the whole of the diverticulum was inverted, and that there was an accompanying intussusception of the small intestine. The literature shows, however, that this is not always the case. Watson Cheyne[5] points out that in a number of recorded cases the inverted diverticulum had merely been responsible for an acute abdominal attack, leading to either peritonitis, due to strangulation of its blood supply, or to gangrene. In his own case[5] the greater portion of the inverted diverticulum consisted of mucosa, the serous coat at its base being the only portion that had become intussuscepted.

Several views have been suggested to explain the inversion of the Meckel into the small intestine.

Kütner[6] considers this due to peristalsis of the diverticulum, which becomes inverted into the bowel in its efforts to expel its contents.

De Quervain[7] expresses the opinion that a rapid flow of the intestinal contents through the lumen of the small intestine produces a negative pressure in the diverticulum, and thus favors its sudden inversion into the bowel.

My own view is that the occurrence depends upon a chronic inflammatory process affecting the mucosa at the base of the Meckel, which results in the first instance in swelling of the mucous membrane and prolapse into the lumen of the bowel. This state of matters may account for pain and hemorrhage, and as the prolapsed mucosa increases in size and becomes more and more lax, it hangs into the bowel like a polypus which the intestine attempts to expel, thus leading to inversion.

My contention that the inversion of the diverticulum is due to chronic changes is borne out by the frequent history of previous attacks of hemorrhage and pain (usually cramping in character).

Coffey's[8] case serves as an example of many others recorded, where previous attacks of abdominal pain and rectal hemorrhage have been in existence. He operated upon a boy aged seven, who, at the age of two, had a severe attack of abdominal pain, cramping in character, which persisted for thirty-six hours. Later he had these attacks regularly every two months, and they were always accompanied by blood in the stools; they persisted for four years. After a very bad attack he was operated upon and an intussusception found, the apex of which was formed by a small inverted Meckel's diverticulum which was in the transverse colon. The intussusceptum was resected and the cut lower ends of the ileum were united by simple suture. The child made a good recovery.

Of my cases, Cases III, V, and VI gave a history of previous attacks of abdominal pain, cramping in character. In Cases I, II, and IV no note was made as to this, and unfortunately it has not been possible to trace them.

Though there is no case on record, it seems quite reasonable to suppose that a Meckel may undergo a natural cure by becoming inverted into the bowel and separated by gangrene.

O'Connor[9] reports a case of intussusception due to an inverted Meckel's diverticulum in a boy aged thirteen who, on the fourth day after the attack, passed per rectum 11¼ inches of gangrenous small intestines with a Meckel's diverticulum attached.

Abnormality at the umbilicus is another point which may be valuable in aiding diagnosis.

Treves[10] states that a congenital hernia is not infrequently present with Meckel's diverticulum, and numerous other deformities of the umbilicus are recorded, from a mere tucking-in to a definite fistula.

Bidwell[11] operated upon a case of intussusception of the ileum due to an inverted Meckel's diverticulum in a boy aged three, on whom he had previously operated for a congenital umbilical hernia when the child was one year old.

In Gray's[1] case he observed the umbilicus to be raised and dome-shaped and the overlying skin to be of a bluish tint and considerably scarred.

A somewhat similar condition was observed in Case VI operated upon by Angus. The umbilicus was large and dome-shaped, but discoloration and scarring were absent. In Case V there was pronounced puckering of the umbilicus. A similar condition was found in Case IV, but the sign was not observed until after death. No note was made of the condition of the umbilicus in any of the other cases.

On careful examination of the umbilical cicatrix in post-mortem subjects dead from other causes, I have frequently found the umbilicus either raised or considerably indrawn where Meckel's diverticulum was present, so that without well-marked evidence of intussusception this sign alone is of little value as a point of diagnosis.

The diverticulum removed from Case V is of interest, having at its apex an accessory pancreas.

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[5] Annals of Surgery, December, 1904.
[6] Beitrage zur klinischen Chirurgie, vol. xxi, 1898 (quoted by Watson Cheyne).
[7] Centralblatt für Chirurgie, 1898 (quoted by Watson Cheyne).
[8] Annals of Surgery, 1907.
[9] British Med. Jour., 1894.
[10] System of Surgery, vol. ii, p. 727.
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PRIMARY SARCOMA OF THE MALE URETHRA.*

REPORT OF A CASE.

BY ERNEST G. MARK, M.D.,
OF KANSAS CITY, MO.
Attending Genito-urinary Surgeon to Kansas City General Hospital.

THE occurrence of sarcoma in the urethra is most unusual, and its appearance as a primary growth in the male urethra is not recorded in the literature. To quote from a monograph by the writer, dealing with new growths of the urethra and presented before the 1908 meeting of this Association:

"To Hoening (*Berlin klin. Wochenschrift*, 1869, page 55) belongs the credit for the first reported case. Rizzoli (*Jour. de med. de Bruxelles*, 1875), Tillaux (*Annals de gynecologie*, 1889), Buttner (*Zeitschrift für Geo. und Gyneak.*, Bd. xviii, page 122), Ehrendorfer (*Centralblatt für Gyneak.*, 1892), Lejars (*Leçons de Chirurgie*), and Albarran have all reported well-authenticated cases of fibrosarcoma. Hall and Frick (*Jour. A. M. A.*, June 23, 1906) record a case of melanotic sarcoma, which they assume from the postmortem findings must have originated in the urethra. The case is unique, but the clinical evidence is well supported.

"Legueu makes the statement based on his investigations that sarcoma occurs exclusively in the adult female. In the case reported by Hall and Frick, the patient was a male, thirty-three years of age.

"Fibrosarcoma of the urethra pursue the same indolent course that characterizes their growth in other parts of the body. Their appearance is in no way typical and their clinical differential diagnosis from fibromata is almost impossible."

The case report of the patient observed by the writer follows:

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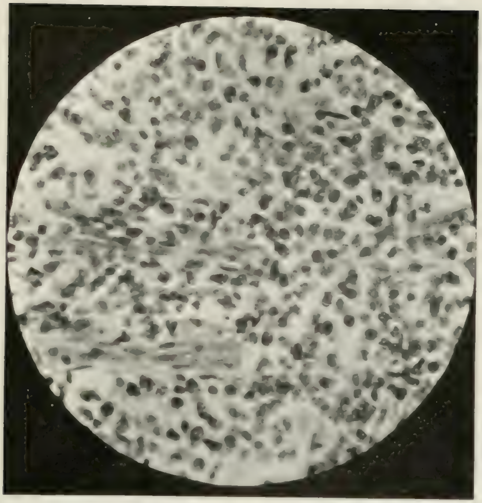
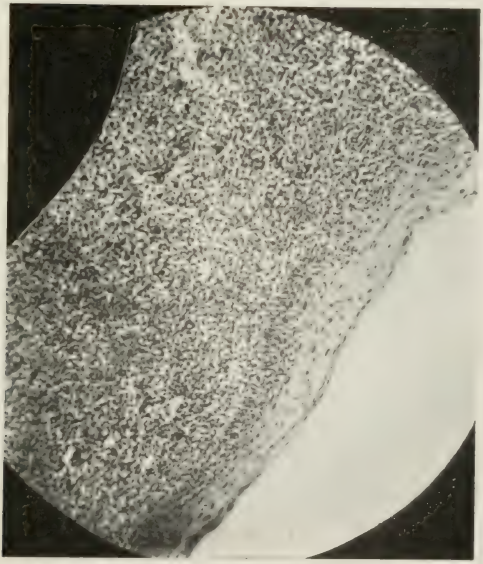
* Read before the 1911 meeting of the American Urological Association.

Fig. 1.



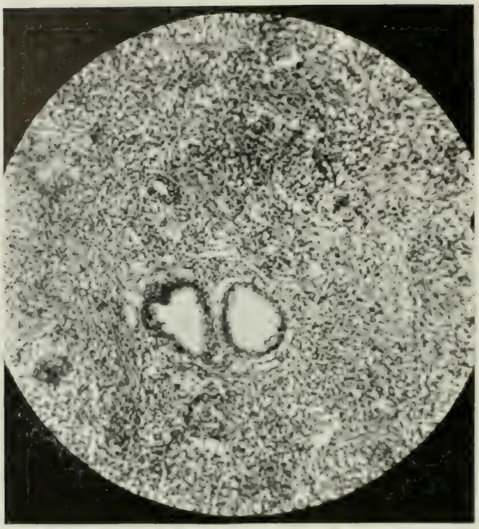
Photomicrograph showing [illegible] of tumor cells and connective tissue.

Fig. 2.



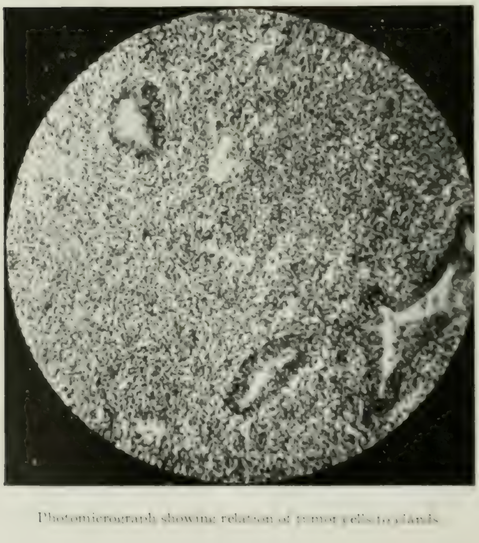
Photomicrograph showing relation of tumor cells to urethral epithelium.

FIG. 3.



Photomicrograph showing relation of tumor cells to urethral glands.

FIG. 4.



Photomicrograph showing relation of tumor cells to glands.

C. R., age twenty-four, Hereford, Texas; occupation, automobile mechanic, referred by Dr. J. D. Griffith. Family history negative. Seven or eight years ago, while on a ranch and out of reach of medical attention, he had an attack of what was, apparently from the history given, acute appendicitis followed by a generalized peritonitis, from which he recovered without apparent sequelæ. In March, 1910, he was operated on for an inguinal hernia. For some two or three weeks previous to operation he had noticed a slight burning or smarting in the pendulous portion of the urethra. After operation he was allowed no water to drink for a few days, and micturition caused pronounced burning in the urethra. On palpation of the penis a small lump or hardened, thickened spot was discoverable about one inch posterior to the glans penis in the spongy body. This was diagnosed without urethroscopy as an ulcer in the urethra, and hand injections given. These injections caused the urethra to become inflamed. The thickened portion extended gradually backward. The patient described it as feeling like a ridge getting smaller both proximally and distally. There was very little pain or discomfort except on urination. Up to four or five months before presenting himself for treatment, no obstruction to the stream was noticed. Pollakiuria had been gradually increasing. At the time of entering the hospital there was a very small stream with accompanying dysuria. From the first there had been a serous discharge from the meatus, which gradually increased and became serosanguineous. For about six weeks previous to examination slight terminal hæmaturia was noticed. He had apparently lost none in weight and appeared well nourished.

Examination.—Abdomen negative. Thorax negative. Examination of the genitals revealed a fairly hard elongated mass, palpable from just posterior to the glans back through the scrotal urethra. This mass showed a decided tendency to become turgescent and much harder on handling without accompanying turgescence of the cavernous bodies. A slight serosanguineous discharge presented at the meatus. The scrotum and contents were normal. The prostate was small and showed no evidence of nodulation. Vesicles normal. No. 10 F. bougie a boule was passed with difficulty from the mid-pendulous portion.

Urethroscopy.—No. 24 F. tube met obstruction just posterior to the corona. Under air inflation, very pale polypoid masses, irregular in outline, were observed, springing from the entire urethral circumference. Using the urethroscopic tube as a curette, these masses were removed with great difficulty as far back as the scrotal urethra. On account of the bleeding and the duration of the operative procedure, it was deemed advisable to postpone any further measures. The masses thus removed were left at the hospital for pathological examination, which was somehow neglected. Six days later the work was taken up where it had been left off, and, utilizing the same procedure as at the former operation, the remaining growths or portion of the growth were removed back to the anterior layer of the triangular ligament.

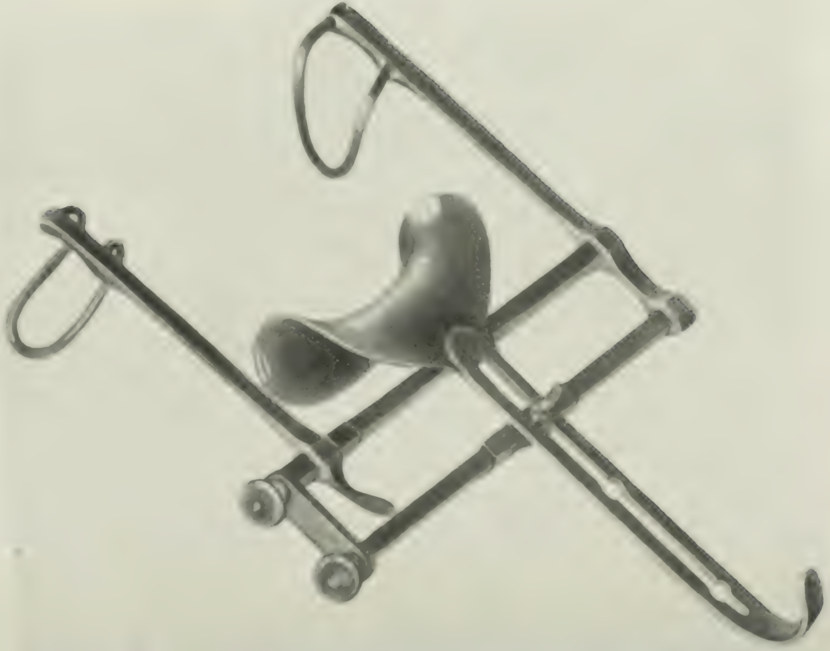
A cystoscope was now introduced without difficulty and examination revealed a high-grade cystitis but no evidence of new growth. The bladder capacity was much diminished.

Suprapubic drainage was instituted and regular soundings done. On account of the pronounced tendency of the growth to recur and the knowledge of its real character this drainage was made permanent. The patient refused radical interference and left the hospital about six weeks later. At the time of leaving the hospital, the growth was rapidly recurring.

The specimens removed were submitted to Dr. Frank J. Hall, whose report follows:

" Gross specimen consists of a number of whitish soft fragments. Section shows sarcoma poor in blood-vessels with small amount of stroma. The cells are of the large round type, with a suggestion of polymorphous cells with vesicular nuclei and pinkish staining cytoplasm. (Frozen section, hæmatoxylin and eosin stain.)"

FIG. 1.



Combined abdominal retractor.

A COMBINATION ABDOMINAL RETRACTOR.

BY DONALD C. BALFOUR, M.B. (Tor.),
OF ROCHESTER, MINNESOTA.
Associate Surgeon to St. Mary's Hospital.

In describing the retractor, a cut of which is inserted, no claim is made to originality, in that the instrument is essentially a combination of two well-known retractors, each suitably modified.

It has been the practice for many years in the clinic at St. Mary's Hospital to obtain exposure in pelvic work by the use of a spreading retractor of the Simpson type, aided by a hand retractor in the lower end of the incision. Recently lateral retraction has been procured by the self-retaining instrument of Gosset, which accomplishes the same result as the Simpson, but is somewhat more simple of construction, easier of application, and more efficient, inasmuch as it holds its position firmly when introduced.

For about a year we have also used a retractor of the Doyen type in the clinic at St. Mary's Hospital. This retractor is eminently satisfactory so far as pelvic exposure is concerned, but seems unnecessarily cumbersome. The chief objection is not in the retractor itself, but concerns its upright portion between the thighs of the patient, which must be of different sizes for different patients. This change is not easy of accomplishment and renders the technic more complicated.

The obvious usefulness of these two retractors, *i.e.,* the Gosset and the Doyen, rendered evident the desirability of combining the merits of both into a single retractor.

An instrument was therefore made from a special design and, with some slight modification, is in use in this clinic at the present time. Reference to the cut renders a detailed description of the instrument almost unnecessary. The Gosset is changed to obtain a fixed point to hold the middle blade of the instrument. This is procured by an extra bar on which is a sliding set screw. The Doyen is fitted with a short flat handle about an inch wide and six inches long, with a central open portion throughout the entire length. The application is very simple. After placing the self-retaining portion in the wound with the cross-bars toward the lower end of the incision, the necessary lateral traction is procured by separating the limbs of the instrument. The second part is now placed in the wound and tracted into the lower part of the incision until the desired exposure is obtained, when the screw is clamped, fixing the blade.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held December 4, 1911.

DR. R. G. LE CONTE, President, in the Chair.

A CHILD WITH RUDIMENTARY LEFT UPPER EXTREMITY (PEROBRACHIUM).

DR. PENN G. SKILLERN, JR., exhibited the patient. He was a male, aged 5 years, the second youngest child of healthy and normal Irish parents. Five brothers and sisters healthy and well formed. Patient presents no other abnormalities or defects, congenital or acquired.

As shown by the sketch (Fig. 1), the left upper extremity is very rudimentary, extending but little more than half way down the chest wall, to which it is adherent, instead of down nearly to the left knee. The limb terminates in a free foot-shaped projection, of which the heel corresponds to a rudimentary thumb and the remainder to a partially flexed and fairly well-developed index-finger.

Movements of the limb are principally elevation of the shoulder and flexion of the remaining dwarfed segments.

External examination reveals a fairly well-developed clavicle, an acromion, a very small humerus, an elbow-joint, small forearm bones, and in the index small nodules of bone corresponding to a carpal, a metacarpal, and a phalanx. The presence of the elbow-joint was confirmed by Dr. Astley P. C. Ashhurst.

Internal examination by Röntgen rays served to orientate the skeleton of the limb more accurately. The first skiagram taken (Fig. 2) shows a comparatively well-developed clavicle, a rudimentary acromion, coracoid process, humerus, forearm, carpal, and digit bones. As it was afterward determined, the scapular spine was obscured in this picture by the shadow of the clavicle. Because the glenoid rim and elbow-joint were not well shown, another skiagram was taken (Fig. 3). Now the upper extremity of the humerus was found in juxtaposition with a rudimentary glenoid, from which there faded away below an indistinct axillary border. The scapular spine is now shown. The position of the elbow-joint is brought out by the partially flexed forearm. The radius and ulna here form a common shadow.

Epiphyses are lacking, and the bones have advanced but little in development beyond a stage represented by the early months of intra-uterine life.

It is not claimed that this interpretation of the skiagrams is wholly accurate, but it is the result of careful study, in which the author sought the aid of Professors G. A. Piersol, H. K. Pancoast, G. G. Davis, and T. T. Thomas, and the artist, Mr. Erwin Faber. The case occurred in the service of Dr. B. A. Thomas, at the University Hospital.

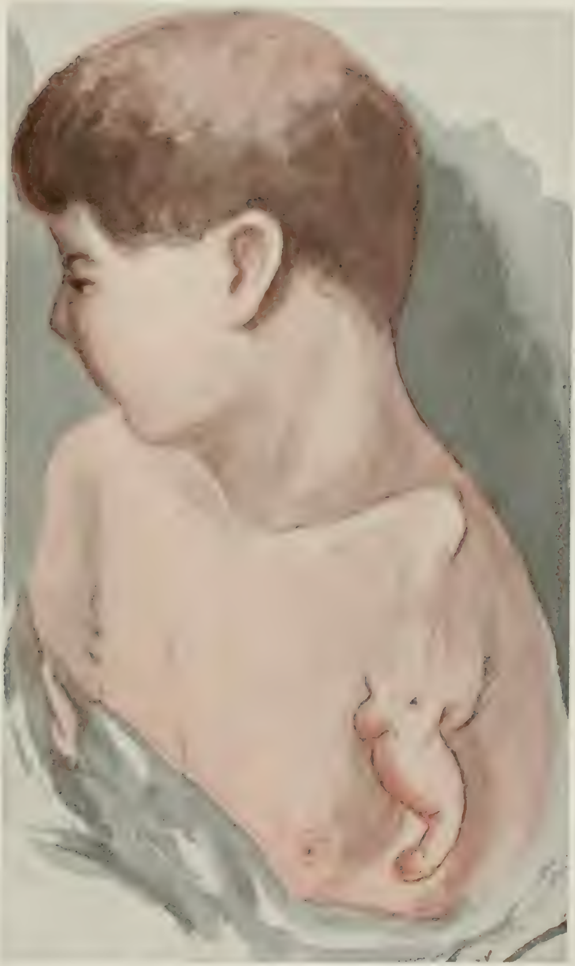
To crown the interest of the case there is the usual history of maternal impression. The mother, when two months pregnant, answered the door-bell in response to a mendicant who exhibited to her his left shoulder, which bore the stump remaining after a railroad-amputation of the upper extremity.

LITHOTOMY UNDER SPINAL ANÆSTHESIA.

Dr. Harry S. Carmany read the history of a man, 61 years of age, who was admitted to St. Timothy's Hospital with a vesical calculus. On account of a chronic cough it was thought a suitable case for spinal anæsthesia, which was employed according to Professor Bier's original method, between the fourth and fifth lumbar vertebræ, first using ½ c.c. of a 1:1000 adrenalin solution, along with 2 c.c. of normal salt solution, waiting five minutes and then introducing 2 c.c. of a 1 per cent. solution of cocaine. After waiting ten minutes the operation was proceeded with. Anæsthesia was complete from twelfth rib down. Operation was started about 5.10 P.M. and completed about 5.40 P.M. Did not have return of sensation until 7 P.M. and was not complete until 9 P.M., although at 5.50 patient had profuse sweating, was slightly excited, felt a little faint, and had a subnormal temperature. Strychnine and atropine were given with prompt improvement. At 8.30 was given alcoholic rub, as sweating was still profuse. The stone was removed suprapubicly, with drainage tube for four days, when permanent catheterization was instituted for a week or ten days. Convalescence uninterrupted. Suprapubic wound healed four and one-half weeks after operation.

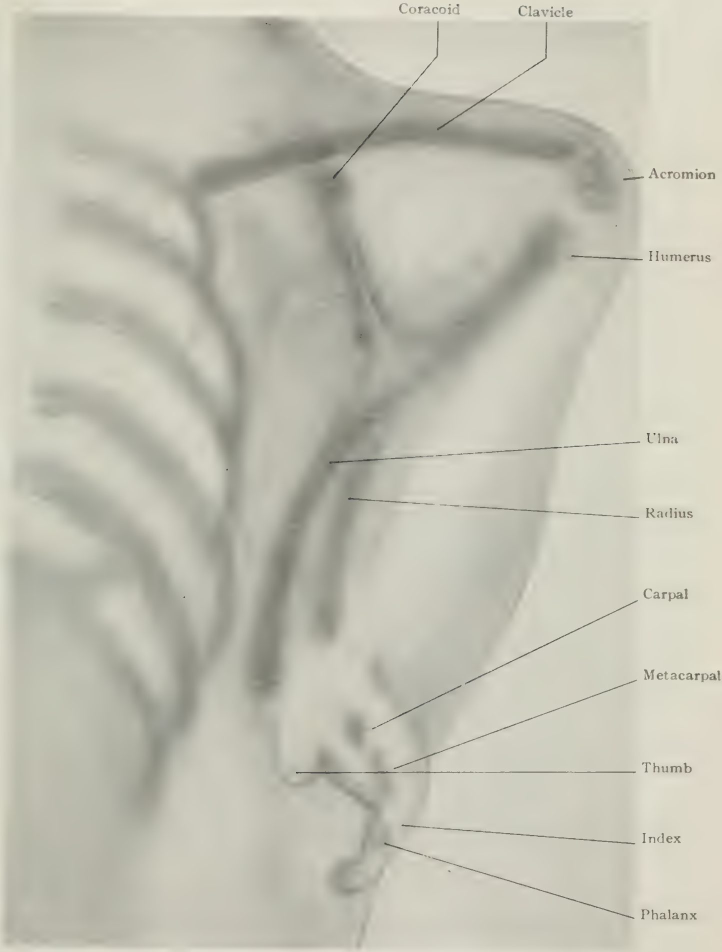
Dr. B. A. Thomas called attention to another method of

FIG. 1



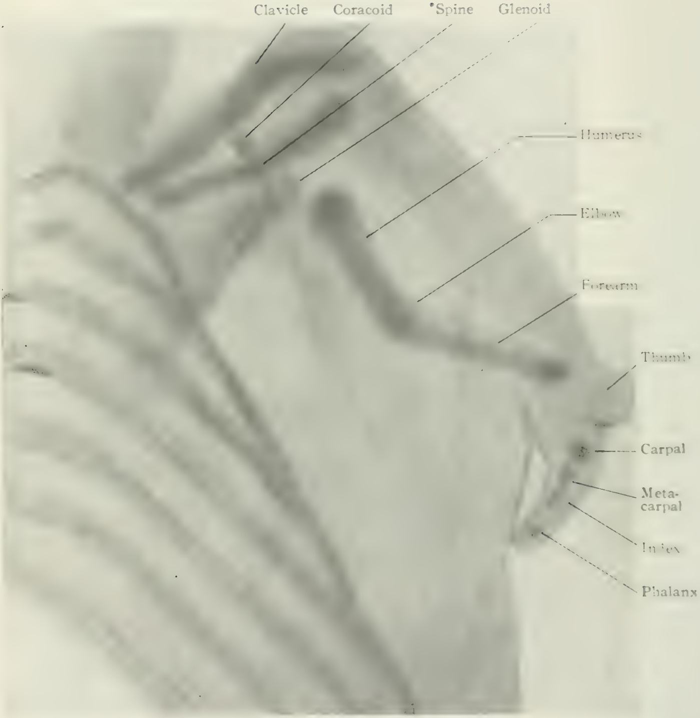
Rudimentary left upper extremity (perobrachium).

FIG. 2.



Rudimentary left upper extremity (perobrachium).

FIG. 3.



Skiagram of left upper extremity taken from behind and mesially forward and laterally.

removing vesical calculi, particularly small ones not more than half a centimetre in diameter, namely, by the use of Young's cystoscopic rongeur. About six weeks ago he had a case in which there were two small calculi which were removed by this method. The device consists of a beaked instrument shaped somewhat like an ordinary urethral sound which opens out on a hinge on its posterior surface like a clam shell, and passing through the hinge, as it were, is a straight cystoscope through which the stone is seen while grasping it with the expanded tip. One of the two stones removed by the use of this instrument was really larger than is applicable to this method and therefore had to be crushed before it could be removed.

Dr. James P. Hutchinson said apropos of spinal anæsthesia, that some years ago Dr. Le Conte and he were abroad together, and saw Dr. Tuffier use his spinal anæsthesia. After returning home they tried it regularly in the first fifty or more cases of operation below the umbilicus; it was uniformly successful, but the large majority of patients objected to the mental depression and, in many cases, the headaches that followed its use. They then discontinued its use, but he had recently taken it up entirely in prostatic and bladder cases if the patients would allow it.

It has an advantage which Dr. Carmany did not mention, and that is that there is absolute and complete relaxation of the patient. In a bladder case, using ether, one is apt at times during the operation to get rigidity of the abdominal wall, which never occurs in spinal anæsthesia. Spinal anæsthesia also has a great advantage in that in elderly individuals the patient can be gotten out of bed in four or five hours after the operation, after the effect of the paralysis of the lower limbs has subsided, while with ether they are apt to have nausea and vomiting and be upset for a day or more, with a much greater probability of subsequent pneumonia.

Dr. Astley P. C. Ashhurst referred to a recent paper by Dr. Bevan, of Chicago, in which he unqualifiedly condemns spinal anæsthesia. There is no doubt whatever that there are a great many cases where local anæsthesia will do as well. It will not do to use local anæsthesia in removing an enlarged prostate, but it can be used in doing suprapubic cystotomy and even in removing a stone from the bladder. If a surgeon has a little patience and a light hand, and keeps the operating room quiet, he can do many operations under local anæsthesia without resorting to the more dangerous spinal form.

Dr. Charles F. Nassau believed with Dr. Ashhurst that if simpler means were tried the same results could be attained without treading on such dangerous ground in many cases. If one has persevered in obtaining a more or less extensive experience with local anæsthesia, infiltration anæsthesia, there are very few operations within reason to which the method cannot be applied. Hernias, bowel resections, exploratory sections, amputations of the arm and thigh can be perfectly well done under local infiltration and nerve blocking. There is no objection to combining anæsthetics, for instance, in operating for a tightly strangulated femoral hernia, which is one of the more difficult types under local infiltration because it is a little hard sometimes to reduce the constriction without causing the patient some pain. In such a case the patient can be given a few breaths of nitrous oxide. One can benumb the patient thoroughly with morphine before beginning, and personally he would feel that while operation should never be refused if strongly indicated in the aged, yet he would go a long way before he would use spinal anæsthesia, the use of which may possibly result in later trouble. He knew of two patients who, he had been told, are wrecks from spinal anæsthesia used for the purpose of operating on hemorrhoids.

Dr. Robert G. Le Conte said that he had had very much the same experience as Dr. Hutchinson. When they were together some years ago at Tuffier's clinic, they were impressed by his method and technic of administering spinal anæsthesia and with the results obtained at the time of operation. Under this stimulus they tried it on a number of cases at the Pennsylvania Hospital. Their conclusions were that in old people, with bad arteries, bad kidneys, and poor circulation, this anæsthetic was the safest one that could be used. He had done a number of grave operations on patients of this type, without shock or variation in the pulse-rate. He had not had the good fortune to do major operations under infiltration anæsthesia with as little disturbance to the nervous system and to the circulation as under spinal anæsthesia. He had, therefore, become a firm believer in, and a strong advocate of, spinal anæsthesia in this limited group of cases.

Dr. George G. Ross thought one of the great difficulties with regard to stovaine is that there is no standardization of the dose with regard to the weight or age of the patient, and hence what would be an overpowering dose for one man may totally fail to anæsthetize the next one. He had seen one fatality under stovaine in a case of strangulated hernia; in this case he thought a local anæsthetic would have been preferable. The patient died promptly after the stovaine was thrown into the membranes around the cord. He had seen a number of cases where active and violent convulsions resulted from the combination of strychnine and stovaine. It took considerable time and prolonged artificial respiration to tide the patients over the immediate effects.

THE INDICATIONS FOR AND AGAINST THE OPERATIVE TREATMENT OF SIMPLE FRACTURES.

DR. JOHN H. GIBBON read a paper with the above title, for which see page 329.

DR. RICHARD H. HARTE said that the operative treatment of fractures which has been so much before the profession of late years is largely the outcome of the imperfect treatment accorded these patients. Again, it is largely due to lack of interest on the part of many surgeons who should know better how to treat fractures than they do; they rarely take but a passing interest in fractures until they find they are resulting badly, their attention being called to this fact by the house officer.

He was exactly in accord with Dr. Gibbon in regard to the treatment of special fractures. Take fractures of the shaft of the humerus, around the anatomical and surgical neck. Those of the anatomical neck are comparatively rare. There is very little disposition for entanglement and the question here is more of reduction and retaining the arm in position after reduction; a satisfactory result follows in the great majority of cases, particularly if the suggestions presented in this paper are followed. Again, the same thing may be said about the elbow-joint and in the shaft of the humerus. In the treatment of all fractures the question should come up with regard to the displacement: What is causing it, is it muscular, or is it a result of the bones being driven past each other by violence, or due to entanglement? In his experience, except where there is entanglement, one can usually reduce all fractures. By entanglement he meant pieces of muscle, fascia, etc., getting between the ends of the bones, and these can be eradicated only by exposing and removing the obstructing material.

There are certain bones and certain portions of bones in which entanglement is more frequent, each as in the central portion of the bones of the thigh because of the great masses of muscle surrounding them, in the forearm, and also in fractures of the tibia. In fractures of the shaft of the thigh Dr. Gibbon has very properly emphasized the importance of bringing the lower fragment to the upper fragment in fractures high up; Dr. Agnew laid stress upon this point years ago. He used a double inclined plane and made extension a little below the knee.

He was strongly of the feeling that if surgeons will carefully analyze their fractures and find exactly what the displacing element is, they will get better results than they are getting to-day. Often on taking an X-ray, when the fragments are apparently in position it is found that a great deal of displacement exists, particularly laterally; the plane of fracture is almost straight, but the bones are separated from one-half to three-quarters of an inch with tissue between; these cases should be operated upon. He did not know any class of surgery where the judgment of the surgeon is more taxed than to say what cases should be operated upon and what should not. The reason ununited fractures occur is because a band of fascia or piece of muscle has gotten between the ends of the bones.

Another important point is the necessity of going into these cases before it is too late, not after subjecting them to extension for four, five or six weeks. The surgeon should find out as soon as possible whether he had gotten the fragments in position; then he should not wait too long, because it complicates the operation materially; the changes for repair are much better the earlier the operation.

With regard to Pott's fracture, he had seen such cases operated upon, but he did not think they should be. If treated intelligently, by carrying the foot well in a fracture box with two pieces of bandage and binding the leg around, or putting on the Dupuytren splint, one will get satisfactory results. It gives a chance for the deltoid ligament to recover itself, and a patient after a fracture of this sort should walk on the outside of the foot because the ligament will gradually give way, and in time if the foot is well carried in it will just about balance itself.

Dr. John B. Roberts said that he recalled looking a few months ago over a paper by a New York surgeon, in which were reported quite a large number of cases of fractures of the thigh bone operated upon because they had been united in malposition or because they could not be reduced. He read carefully his statements as to the previous line of treatment and in a large proportion the patients had never been subjected to efficient non-operative surgical treatment. Nearly all of them had been treated by long external wooden splints or other splints, or by an inclined plane, and not by extension with Buck's stirrup and pulley or other methods of maintaining traction. For one to operate on fracture of the shaft of the femur, because it could not be reduced, when he never had tried continuous traction with 25 or 30 pounds weight, is in his opinion an error. If he had previously seen these cases himself and treated them in a rational manner, doubtless operation would not have been considered necessary. He thought Dr. Gibbon to be entirely right in stating that the great majority of fractures can be treated by non-operative means; and that when this is not successful the failure is due to either the patient's own negligence, or to a want of mechanical sense and attention on the part of the surgeon. It is often due to the fact that the after-treatment is conducted by young medical men or by nurses, who are not familiar with the mechanical principles involved and the anatomical displacements. Each individual case should be treated in accordance with the mechanical and anatomical problems involved. In a great majority of fractures of the humerus or the bones of the forearm and of the bones of the lower extremity, the surgeon will obtain good results without operation, if he has a mechanical turn of mind and gives intelligent and frequent supervision to the patients. It will not do, however, to leave them to doctors or nurses without experience and knowledge of non-operative methods. He discovered not long ago that fractures of the femur treated by him in a hospital had been accustomed to have a bedpan about two or three inches high put under them by the orderly while the broken limb was weighted with from 15 to perhaps 30 pounds. He only found it out by seeing the thing occur as he walked into the ward. That is the kind of thing that surgeons' indifference and negligence in fracture cases have allowed to go on in hospitals; and it perhaps accounts for the lack of good results in many cases. Dr. Gibbon is right, that attentive surgical observation will prevent many bad results.

It seems proper to lay stress on the treatment of fractures by gypsum splints. The average surgeon nowadays pays no attention to the use of plaster of Paris as a means of making a perfectly fitting splint.

The X-ray is a valuable adjuvant in diagnoses; but it is a most incorrect aid unless a surgeon supervises the taking of the picture and then uses his own fingers and clinical sense to act as a source of contrast and addition to the X-ray plate. In some hospitals the patients are taken out of bed, put on a stretcher, and taken to the X-ray laboratory by a probationer nurse or inexperienced resident. It is perfectly possible for the X-ray man to make almost any kind of a picture by changes in the line and angle of the rays. We are liable to pay too much attention to the X-ray picture and think we have a badly set fracture when the truth is that the appearances are factitious. It requires often the combined knowledge of the radiologist and the surgeon to correctly translate the shadow picture.

Dr. Gwilym G. Davis said that Dr. Gibbon's paper brings up one aspect of surgery that is suggestive, and that is the relation of the conservative to the radical, and the question of the conservative treatment of surgical affections of the extremities. When it comes to a discussion as to whether the treatment of certain cases shall be conservative or radical, it devolves upon the surgeon to be qualified to decide that question. In other words, he should know what can be done by conservative means; to be qualified to treat a part conservatively he should understand conservative methods and should be willing to take the time and trouble to become familiar with and carry out such methods. The tendency in the development of surgery during recent years has been toward visceral surgery; the consequence has been to drift away from extremity surgery. Visceral surgery has developed to such a tremendous degree that it has been practically impossible for many surgeons to keep pace with the developments of surgical science in conservative fields, and we therefore see them devoting their attention almost exclusively to operative and visceral surgery, the abdomen, brain, etc., to the exclusion practically of such things as fractures and other surgery of the extremities. Still retaining their position as general surgeons to institutions, these cases of fracture, etc., fall under their care although they have not kept pace with the development of the conservative side of the art. The consequence is that they must do one of two things, either relegate the treatment of these cases to others, or undertake them themselves. Some do one thing, some another. When they undertake the treatment themselves, they are confronted with the alternative of either treating them inefficiently conservatively, or else operating upon them, and likewise inefficiently, and it has been a matter of surprise to him that Mr. Lane's work, commendable as it is along some lines, has aroused such enthusiasm. No one could admire his technic more than the speaker, and yet the choice of his cases leaves much to be desired. Exactly what course will be pursued by the surgical profession is a matter of great interest. If the general hospital surgeon is going to treat fractures in the future, he will have to begin to study fractures from a conservative stand-point, and perhaps after the furor which has recently occupied the surgical world for visceral surgery has passed, there may be a reaction, and then these cases will again receive the attention which they deserve. In the meantime, however, some institutions are finding a solution of the problem by turning such cases over to the members of the staff who are accustomed to deal with things from a more conservative and mechanical stand-point.

Dr. John H. Jopson asked whether the amount of extension applied by Dr. Gibbon relatively to the arm and forearm and thigh. In the past he had often been content with an insufficient amount of extension in the treatment of fractures of the thigh, and lately he had been in the habit of increasing the weight with less regard to the age of the patient, until satisfied with the reduction obtained. He did not know whether in doing this the ligaments of the knee-joint might be injured. The question of the strength of these ligaments must be considered both in the treatment of simple fractures by Buck's extension, and in the newer methods of reduction, for example, that employed by Dr. Lemon of Milwaukee, which he recently demonstrated in this city. In Lemon's apparatus, one in which the mechanical details have been worked out in the nicest manner, the extension which is used to effect reduction is applied to the ankle by means of a special gaiter, which is removed after the plaster cast has set. The amount of extension employed can be carried up to 150 pounds. In Martin's method the extension is applied directly from the upper end of the lower fragment. Lemon's apparatus he applied for in one case and Martin's apparatus as modified and perfected by Eliason he had used very recently, and undoubtedly if there is no danger in the application of this very great amount of force below the knee-joint there is an advantage in the use of Lemon's apparatus, because in Martin's method you have to remove the retractor before pinning or plating the fragments.

Another question in the experience of the author is shock in operating on fractures of the femur, especially in the upper portion. As everyone knows there is oftentimes serious shock in operations on the femur, and in cases where the hemorrhage is slight may it not be that the traction itself can be responsible for this shock?

In spite of the opposition manifested in some quarters to the operative treatment of fractures, one must realize that in selective cases it has come to stay, and that we will be in the future less and less satisfied with incomplete and imperfect reduction of fractures.

Dr. John H. Gibbon (in closing) said that he thought highly of Lane's plates and that there is no technic better than his, but what he had seen is a plate employed in fractures and applied to bones where it should not be used; for instance, on the olecranon, the internal malleolus, and the patella. Lane has done the best work of any man in the treatment of fractures. His selection of cases, however, seems bad, that is, he takes cases which we would not operate on. A great many of the cases which are reported by many operators are those which the surgeon has not seen until a resident or his assistant says, "We have a bad result and I guess you will have to operate," and this after partial union has taken place and a lot of callus developed. Such a case should have been operated on just as soon as it was discovered it could not be gotten into proper position. Late operations give bad results.

As to the residents: He finds residents get enthusiastic about the same things their chiefs get enthusiastic about. If one shows a certain amount of interest in fractures and demonstrates to the resident what he can do, for instance, in fractures of the upper end of the humerus by abduction, he will be impressed and become interested, and if, on the contrary, one pays no attention to the fracture cases, he will only call attention to them when they are in bad condition for operations and beyond mechanical correction. Surgeons want to familiarize themselves with the improvements that are made in the mechanical treatment of fracture just as much as the improvements in technic. General surgeons are competent to treat fractures, but when it comes to operating on them the man who understands this should be very familiar with such work.

There is one point he wished to emphasize, and that is the matter of continuous traction. Ten pounds kept up for a week will do more than 30 pounds for half an hour. Regarding the shock in thigh fractures, he thought that the shock accompanying and following fractures of the thigh is often one to fat embolism. He had no proof at all, excepting that large amounts of fat are eliminated in fracture by the urine. The student is to-day not receiving the amount of instruction in mechanical treatment of fractures that he should and it must be made up to him during his internship by those under whom he serves.

FRACTURE-DISLOCATION OF THE SHOULDER.

Dr. William J. Taylor reported the history of a man of 50 of lax fibre and poor muscular development, who in the spring of 1910 made a misstep and in jumping forward to regain his balance placed his foot upon a small rug lying upon a hard-wood floor. The rug slipped and threw him forward, and in his efforts to save himself from falling, he extended his left arm, his hand coming with great force against a wall. A dislocation of the shoulder resulted. As the accident happened in the country, there was some delay before he could be seen by a physician. Finally a man of large experience and a most excellent practitioner gave him ether and after a careful examination reduced the dislocation without difficulty, using his foot in the axilla. The arm was then bandaged to the side. Forty-eight hours afterwards he came into town and was seen by Dr. Taylor for the first time. Patient suffered great pain; there was marked swelling, and the bandage was so tight that blebs had formed on the forearm. Dr. Taylor could feel the head of the humerus in its broken place, but the swelling about the shoulder was so great that an accurate examination was impossible. There was an extensive ecchymosis. The swelling gradually subsided, but pain was persistent and an X-ray taken of the shoulder showed the true nature of the injury. The anatomical neck, or rather the articulating surface of the bone, had been shelled off and remained against the chest-wall beneath the pectoral muscle.

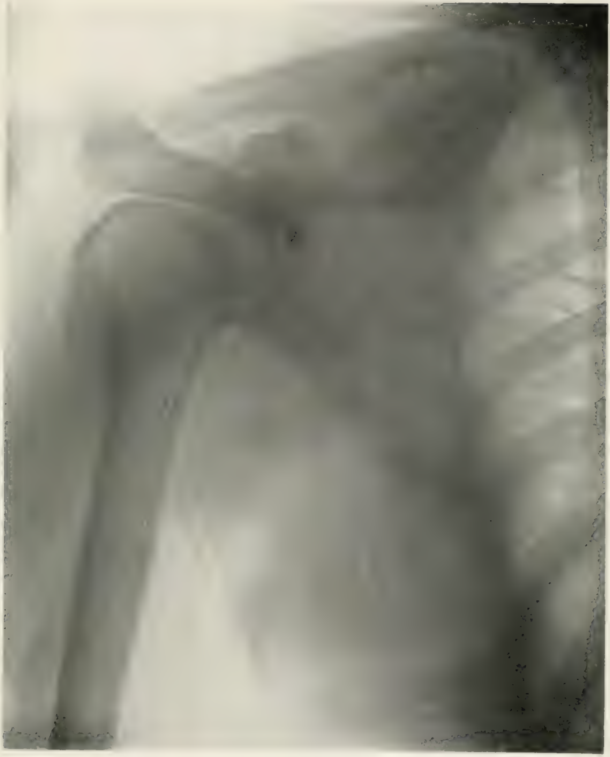
He operated by making an incision along the posterior axillary fold and dissected down past the vessels well into the axilla. The piece of bone could be easily felt through the wound, but so near to the vessels and nerves that it was impracticable to remove it by this route for fear of doing serious damage. Through the same incision he now dissected below the vessels and toward the pectoral muscle and by splitting it the piece of bone was removed. The remainder of the head of the humerus was in place in the glenoid cavity and the capsule of the joint firmly united. The joint was moved freely and a drain of iodoform gauze introduced into the cavity from which the piece of bone had been removed. Convalescence was uneventful, and the patient has a perfectly useful arm and a movable shoulder-joint.

Dr. John H. Jopson said that he saw a case almost identical with this in an old colored woman in the Polyclinic Hospital Dispensary, with an injury of the shoulder which he diagnosed at first as fracture of the anatomical neck. The tuberosities were pulled upward so that no depression was felt below the acromion. The X-rays showed the head in the axilla, and he made an anterior incision and removed it.

Dr. Charles F. Nassau said that four years ago he had an exactly similar injury occur to a patient of his. The man was very stout and flabby, extremely poor physical condition particularly due to dissipation, and he fell out of a low window to the porch, was brought to the city, and was supposed to have had a dislocation which was practically reduced, but the pain persisted. An X-ray was taken by Dr. Sweet, and it was after that that he came under his care. He feared very much to do anything with it, but the X-ray, although not good, was sufficiently so to show a thin " butter plate " torn from the head of the humerus and driven down between the head of the bone and the chest wall under the pectoral muscle. He made an incision through the anterior edge of the deltoid, smoothed the edges after removing the loose piece, and closed the wound with not more than three stitches. That man has a perfectly good arm. With persistent and long-continued massage he has obtained a good result with a freely movable joint.

Dr. Gwilym G. Davis said that when he was Dr. T. G. Mor-

FIG. 4.



Fracture-dislocation of shoulder.

ton's resident he came in contact with a case very similar to this, in which he made an incision just under the edge of the pectoralis major and withdrew the head of the articular surface as did Dr. Taylor. As a person grows older, the line of fracture recedes until it reaches through the anatomical neck, but in this case it has been a little lower and includes a little portion of the upper part of the tuberosity, and on the illustration will be seen a fragment which looks as if part of the tuberosity had been torn.

Dr. John H. Gibbon said that he had an X-ray picture taken of every fracture he treats. The time to take the picture is after the reduction. It is important to teach men that the thing they must do is to have a picture taken, and if not it is up to the patient, because so frequently patients turn up who never had a picture taken and have a bad position. Everyone taking a fracture must ask for an X-ray plate. As Dr. Harte has shown, it may sometimes mislead. He had seen two fractures that from a clinical point of view were perfectly apparent but which did not show in the X-ray plate because it was only taken in one line. With a stereopticon picture there is no excuse for a misinterpretation. We often do not need it as a diagnostic means, but rather as a confirmation of the proper reduction of the fracture; he does not consider it a criterion as to the result.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, Held at the Presbyterian Hospital, November 22, 1911.

The President, DR. CHARLES L. GIBSON, in the Chair.

RECURRENT PANCREATIC CYST.

DR. CLARENCE A. MCWILLIAMS presented a woman of 50, who was first admitted to the Presbyterian Hospital on October 25, 1910, her chief complaint being pain in the left upper abdomen. Her history dated back fourteen years, when she had her first attack of pain, which started in the left upper abdomen and radiated upward to both shoulders; never down or around to the back.

Examination of the upper abdomen showed a transverse, indistinct mass, about the size of a grape-fruit, with its lower border extending four inches below the navel. It was smooth, not tender, dull on percussion, and deeply situated.

On October 28, 1910, an exploratory laparotomy was done through a median incision. Above the navel and occupying practically the entire left upper quadrant of the abdomen, was found a very large, smooth, cystic swelling, which lay behind the stomach and extended up to the diaphragm. Its position was that usually occupied by the pancreas. A needle was passed through the lesser omentum, and then, with a trocar and cannula, at least a quart of fluid, turbid, odorless, and chocolate colored, was drawn off. A tube was then sewn into the cystic opening with purse-string suture. The abdominal wound was then closed about the tube, and the patient made an uneventful convalescence.

During the first 24 hours, about eight ounces of fluid drained through the tube. Two weeks after the operation, this fluid gave a faintly alkaline reaction, with a specific gravity of 1022. The fat-splitting reaction was present, with a marked reaction; the diastolic ferment was also present as well as a marked trypsin reaction.

The tube was left *in situ* for eighteen days, and then drawn outward so that its end lay just inside of the abdominal wall. The patient left the hospital on December 4, 1910, afterward visiting the accident ward for dressings. The sinus in the abdomen continued to discharge for three months longer, and then healed entirely and remained so.

The patient was readmitted to the medical division of the hospital on September 1, 1911, complaining of pain in the left hypochondrium, which was at times dull, at other times sharp. She had lost flesh and strength, and suffered at times from nausea and vomiting. On physical examination a very indistinct soft mass, not tender, was felt in the left upper quadrant of the abdomen. A Wassermann reaction was negative, but a Cammidge reaction was positive.

Operation, September 15, 1911: An incision was made through the old scar. Through the stomach could be felt a smooth, cystic mass, about the size of a grape-fruit, lying below the diaphragm in the left upper quadrant. The gastrocolic omentum was incised, the cyst wall exposed, and the cyst aspirated and opened, and a section of its wall removed for examination. A finger inserted through the wall of the cyst extended upward to the diaphragm and to the left as far as the spleen. The cyst wall was sutured to the abdominal wall, as complete incision of the cyst was impracticable. A tube was left inside of the cyst.

A microscopical examination of the cyst wall showed no epithelial lining, and no pancreatic tissue was found in the sections. An examination of the fluid from the cyst showed the presence of weak ferments.

The patient made a smooth recovery from the operation. On September 25, an examination of the fæces showed poor pancreatic digestion. Trypsin and diastatic digestion were diminished, and the total undigested fat was increased to 68 per cent. The patient was then given extract of pancreas, and on October 6 the total fat had diminished to 15 per cent., showing improved pancreatic digestion.

Dr. McWilliams said he attributed the recurrence of the cyst in this case to the fact that at the first operation the cyst wall was not sewn to the abdominal wall, causing it to close too soon.

RETENTION CYST OF THE PANCREAS.

Dr. Ellsworth Eliot, Jr., presented a man, 46 years old, a native of Hungary. His occupation was that of a salesman. His family history was negative, and his past history, with the exception of the fact that he had suffered from constipation for the past ten years, was unimportant.

About a fortnight prior to the patient's admission to the Presbyterian Hospital, on October 2, 1911, while walking, he had a sudden, sharp pain in the left side of the abdomen. This was increased on deep inspiration, and upon examination the patient noticed a swelling just below the left costal margin; this was painless on pressure. The sudden pain, which persisted, was most severe in the left hypochondrium; it did not radiate, and was relieved by lying down on the left side. There was no vomiting. The appetite and digestion remained good up to a few days before admission, when the patient had a sudden chill; no fever. The swelling gradually increased in size.

Upon admission, the patient's temperature was 98.5°; pulse, 88; respirations, 22. In the left upper quadrant of the abdomen, bounded by the midline and on a level with the umbilicus, there was an ovoid swelling about the size of a large cocoanut. It was elastic to the feel and dull on percussion. It moved with respiration, and was not adherent to the overlying skin. Upon inflating the stomach, the mass almost entirely disappeared, but only temporarily.

The peritoneal cavity was opened by a vertical incision through the upper outer part of the left rectus. A large cyst immediately presented, pushing the gastrohepatic omentum forward. The cyst wall was exposed by a reflection of the divided gastrohepatic omentum to either side, and after examination of its content the portion of the cyst wall was excised and the edges sutured to the parietal peritoneum. The cavity was drained by a rubber tube and the incision in the abdominal wall closed by the usual suture.

After the operation the discharge was abundant and contained pancreatic ferment for three weeks. It then suddenly diminished and during the past month has varied considerably in amount. At present there is practically no discharge and the wound healed.

FRACTURE OF THE OLECRANON.

Dr. McWilliams presented a woman, 50 years of age, who was admitted to the Presbyterian Hospital on September 20, 1907, ten days after she had sustained a fall upon her elbow.

On examination, one could feel a fracture of the olecranon, with separation of the fragments of about half an inch. An X-ray photograph showed a transverse fracture of the olecranon, about an inch from its upper extremity, the fragment being displaced upward and backward by the triceps so that its fractured surface looked posteriorly.

An incision five inches long was made over the posterior surface of the olecranon, and the line of fracture exposed. A hole was drilled transversely through the lower fragment, a quarter of an inch from its posterior surface. A moderate sized aluminum bronze wire was then passed through this hole, threaded on a needle and passed through the triceps tendon, just above the upper fragment. The wire was then drawn taut, and the ends twisted together on the outer side of the ulna. When the skin stitches were removed on the eleventh day, primary union had taken place.

An X-ray picture taken recently, four years after the operation, showed the wire in its original position. The fracture had firmly healed, so that even its location could not be made out by palpation. Flexion and extension were perfect, and there was no pain. The question of whether it is wise to use an unabsorbable suture material about joints is brought up by this case. Usually chromic gut is preferable, but this case shows that wire may be used. Its advantages are that much more freedom is allowed in the position in which the joint is placed immediately after the operation, as well as earlier subsequent active and passive motions. The skin sutures of silk or silkworm gut when placed about joints should be left *in situ* for more than the ordinary length of time, at least ten or twelve days, to prevent subsequent separation of the skin edges.

TYPHOID PERFORATION: CHOLECYSTITIS.

Dr. McWilliams presented a man, 39 years old, who was operated on March 19, 1911, at 4 p.m. He was suffering from typhoid fever, and was then, it was calculated, in the twelfth day of the disease. He had slept well the entire preceding night, and at 7 A.M. complained of a sharp pain in the abdomen, in the region of the bladder. At eight o'clock he was given an enema, which brought away yellow fluid and some soft fæces. Two hours later he felt nauseated and refused milk.

When Dr. McWilliams first saw the patient, at three o'clock in the afternoon, his pulse was 96, temperature 103°, with a white blood-cell count of 13,600. There were rigidity and tenderness of the right rectus, more marked below than above. There was also some tenderness in the left lower quadrant. There was no distention; liver dulness normal; flatness in the flanks. A rectal examination elicited slight tenderness.

Operation, 4 P.M.: The abdomen was opened under cocaine through the right rectus muscle without the slightest pain. Upon opening the peritoneum, some fluid escaped. On attempting to draw the cæcum into the wound, the pain was so severe that ether by the drop method was given. The cæcum and ileum were then drawn out, and a small perforation, the size of a knitting needle, was found about eight inches from the ileocæcal valve. The perforation was closed by a purse-string Pagenstecher silk suture. There was considerable fluid, with a small amount of fæces in the pelvis, which was washed out by means of a catheter attached to an irrigator, by the side of which a suction tube was passed. Two rubber tubes were inserted to the bottom of the pelvis, and the abdominal wound was sutured around them.

On the following morning the patient's temperature had dropped to normal, and remained so for two days, with a pulse of about 100. Then there was a gradual rise in temperature. There was no vomiting. The slight distention was relieved by colon irrigations. The tubes were removed on the eighteenth day, and gauze strips substituted. On the sixth day after the operation, the temperature became higher, reaching 103° on the sixteenth day. This temperature persisted for 21 days, and was due to a cholecystitis, as shown by a very tender gall-bladder region, with muscular rigidity. The leucocytes were as high as 21,800 and the polymorphonuclears 88 per cent. After this the patient made an uninterrupted recovery, and has been well ever since, with no subsequent intestinal disturbance nor pain in the gall-bladder region.

Dr. McWilliams said that in the Presbyterian Hospital they had operated on 20 cases of typhoid perforation since 1900.

Their results had not been brilliant, for only four of these 20 recovered—20 per cent. Armstrong (*British Med. Jour.*, Oct. 29, 1910) stated that in the Montreal General Hospital, from 1897 until May, 1910, there were 2051 cases of typhoid fever, with 93 perforations—4.53 per cent. Of these, 78 were operated on, with 24 recoveries—30.7 per cent. In six of these cases, more than one perforation was found—7.7 per cent. The perforations were generally not far removed from each other.

LATE CONDITION AFTER EXCISION OF THE SUPERIOR MAXILLA FOR SARCOMA.

Dr. C. A. McWilliams presented a man of 40, who was admitted to the Presbyterian Hospital on November 15, 1909, with a hard, bone-like tumor, about the size and shape of a walnut, occupying the right superior maxillary bone, and extending into the right nostril. It was raised as a globular swelling from the side of the nose and face. The skin covering the tumor was not movable, being firmly attached to the growth, which felt like a part of the upper jaw. On the right side, beneath the upper lip, the growth could be seen involving the gums in irregular, nodular projections, which bled easily. The orbit was not involved. The first evidence of the growth had been noticed seven months before. A section of tissue removed showed it to be a giant-celled sarcoma.

Operation, November 16, 1909: After a preliminary injection of morphine, ether was administered through the left nostril by catheter. After ligation of the right external carotid artery, the right superior maxillary bone, with the tumor, was extirpated.

Two years after the operation this patient is perfectly well, without any signs of recurrence. He wears a plate filling in the defect, which is of great assistance to him in enunciating clearly.

BILATERAL LYMPHOSARCOMA OF THE BREASTS.

Dr. C. A. McWilliams presented a woman, 33 years old, who was admitted to the Presbyterian Hospital on June 13, 1911. Two weeks previously she had noticed a lump in the right breast, three and a half inches from the nipple and just to the upper and outer side of the mammary gland. The lump was the size of a large marble, and apparently was not increasing in size. There was no pain nor loss of weight. The woman was the mother of one healthy child, eight years old.

Examination showed a nodule, about the size of a hickory-nut, not tender nor cystic, in the right mammary gland, at its upper, outer quadrant. It was not adherent to the skin nor deeper parts. No axillary nodes were palpable. The remainder of the breast contained no nodules, and the opposite breast was normal.

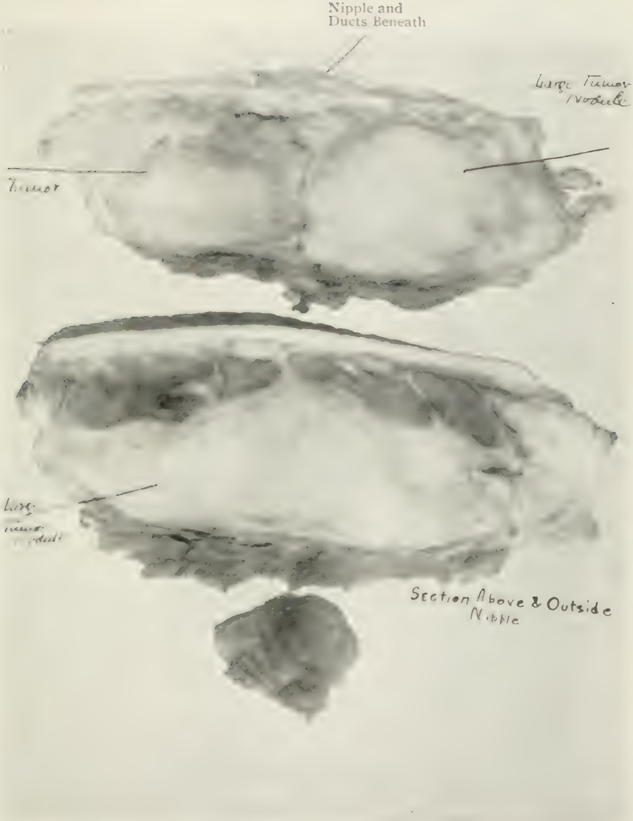
Operation, November 7, 1911: This consisted of the removal of a bit for the frozen section examined, but as the result of this examination was not satisfactory, the wound was closed. A subsequent pathological examination of the tumor was made, and it was pronounced a benign lymphoma.

The patient returned to the hospital on November 5 with a statement that about two weeks after her discharge a small lump had developed in the right breast near the old scar, and following this, other lumps had developed in the same breast, until she now had four or five of them. About two weeks ago she noticed a lump in the left breast. All of these tumors had been steadily growing larger. There was no pain; no discharge from the nipple; no loss of weight or strength.

Examination of the right breast showed three hard, nodular masses. These were circumscribed and freely movable under the skin. There was no tenderness nor fluctuation, and the nipple was not retracted. In the right axilla there was a mass about the size of a hickory-nut. In the left breast there were two distinct masses, also freely movable under the skin, and very hard. There was no retraction of the nipple. They were situated in the upper quadrant of the breast. Nothing could be felt in the left axilla. The Wassermann reaction was negative; the spleen was normal. There were small, palpable glands in both inguinal regions. Spleen not felt.

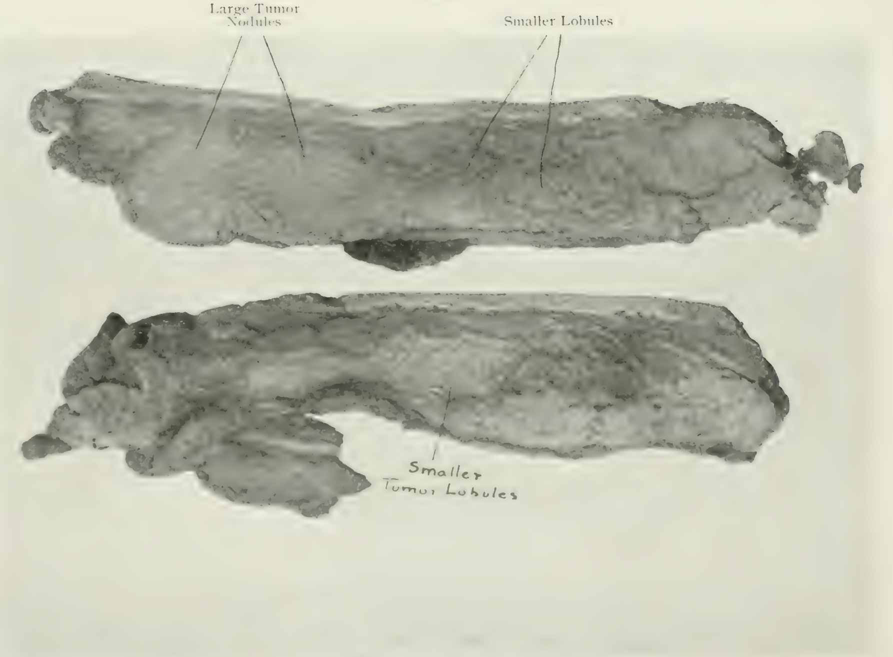
Operation, November 7, 1911: This consisted of the complete removal of the right breast, together with both pectorals and the contents of the axilla where several large lymphatic tumors were removed. Eight days later a similar operation was done on the opposite side. Considerable shock followed the second operation, and that evening the patient's condition was poor, with dyspnœa and a weak, irregular pulse. As there was very poor response to two saline intravenous infusions, a blood transfusion was done at 9 P.M., with the result that the red blood-cells, which were 3,000,000 before the transfusion, were 3,900,000 after it. Elsberg's cannula was used with easy and good results. The patient's

FIG. 1.



Bilateral section of the right breast.

FIG. 2.



Bilateral section of the left breast.

husband acted as donor without preliminary testing of the two bloods. On the following day the woman's condition was good, the pulse being strong and steady.

The pathological diagnosis in this case was lymphosarcoma of each breast, with involvement of the right axillary glands. The wounds all healed by primary union.

The subsequent course of this patient was remarkable, and showed that we had to deal with a case of acute lymphatic leukæmia, the only objective signs of the condition being the mammary tumors.

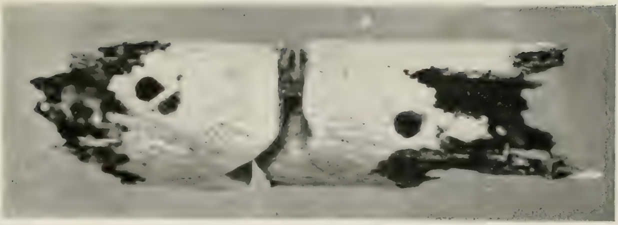
On December 3, examination of the eye grounds showed two hemorrhagic spots in the left retina on its temporal half near region of macula. On December 5, the edge of the spleen was easily felt for first time on deep inspiration. The gums of the lower jaw were swollen, spongy, tender, and with small ulcerations. The temperature was high (December 8), 105.6°, and the patient had occasional shaking chills. X-ray pictures showed no apparent enlargements of any of the lymphatic tissues. The wounds are faultless and perfectly healed.

COMPOUND FRACTURE OF THE HUMERUS, WITH SEQUESTRA: RESULT AFTER WIRING.

Dr. C. A. McWilliams presented a man, 32 years old, who was admitted to the Presbyterian Hospital on November 2, 1911. One month previously he had sustained a compound fracture of the left humerus, at the junction of the middle and lower third, for which he was admitted to a nearby hospital. He immediately began to run a temperature, which gradually increased, and on the fifth day he was operated upon with the diagnosis of compound fracture of the left humerus, with cellulitis. Notwithstanding the presence of infection, the fragments were wired. The incision was made over the outer side of the arm, and a transverse fracture exposed. Two holes were then drilled into each fragment, three-quarters of an inch from the line of fracture, and a silver wire introduced and twisted. A counter-opening was made on the inner side of the arm and both wounds were left wide open for drainage, rubber tubes being inserted. During the patient's stay in the hospital, from October 2 to November 1, he ran a temperature, more or less continuous, and averaging about 102°. During the last few days in the hospital he became wildly delirious and irrational. About two weeks after the operation, the silver wire was found loose in the wound. The patient was expected to die, and he was removed to his home on November 1. When Dr. McWilliams first saw him there on that day, in consultation, the patient was apparently much prostrated, with a very dry tongue and a weak pulse, but with no temperature. He had a compound fracture of the left humerus, the opening into the bone being large enough to admit two fingers. There were several incised wounds on the forearm and on the inner side of the arm. The patient was thereupon sent to the Presbyterian Hospital, permission first being obtained to amputate the arm, should that prove necessary.

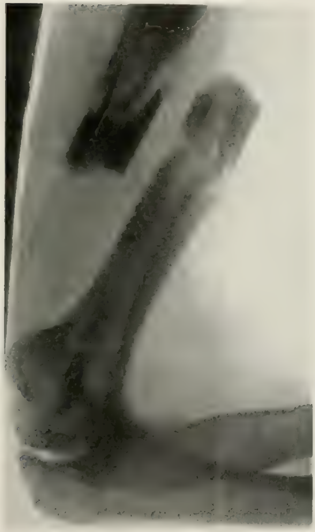
On admission, an X-ray photograph was taken, which showed that the ends of both fragments were necrotic (Fig. 4), and from these, two sequestra were removed (Fig. 3). Each sequestrum involved about an inch of the end of the fragment. The remarkable feature about them was the short period of time it took for them to separate—about one month. This also indicated how great a degree of infection there was introduced into the bones at the time of the operation. For a week after his admission, the man was very irrational and delirious. He was given large quantities of fluids, and at the end of one week he became perfectly rational. His delirium was unaccompanied by any rise of temperature. His wound was now granulating nicely, and the question which came up was, what should be done to effect a union of the fragments? There was now a defect of about two inches in the bone. Would the soft parts contract sufficiently to allow the ends of the bone to be brought together and held there by a Lane plate? If not, Dr. McWilliams said, it was his purpose to implant a bone graft taken from the man's tibia, thus filling in the gap with bone. This graft was to be placed in the medullary space of each end of the fragment. Nothing of this kind, however, could be done until all the wounds had entirely closed. On Dec. 8, the cavity between the fragments had entirely filled in and all that remained unhealed was about an inch wide of the skin surface.

Fig. 3.



Sequestra from compound fracture of humerus.

Fig. 4.



Compound fracture of humerus with necrosis of fractured ends.

RUPTURE OF THE QUADRICEPS TENDON OF THE KNEE.

Dr. Forbes Hawkes presented a man, 40 years old, an engineer, who on January 26, 1911, during the excitement resulting from a fire in the building in which he was on duty, slipped from a box on which he was standing, a distance of about eighteen inches, to the floor, injuring both knees. Following the injury, he was unable to extend the left knee. There was a marked, transverse depression above the left patella, and the parts were greatly swollen and of a bluish color, suggesting a deep-seated hemorrhage. There was also some depression above the right patella, but he could extend the right knee fairly well.

The X-ray plate showed that there had been no fracture of the patellæ, but that the left quadriceps tendon, as it tore, had pulled off a few particles of bone from the upper portion of the patella.

On February 1, 1911, the left quadriceps tendon was sutured in place through a trap-door incision. It was found that it had been completely torn away from its patellar attachment, and that the lateral ligaments had been torn as well, opening the knee-joint on the inner side. The retracted tendon was easily brought down and sutured to the rough upper surface and to the periosteum of the patella with double No. 2 chromic catgut sutures. Both lateral ligaments were also sutured with chromic gut. The skin was closed without drainage, and the limb put up in extension on a moulded posterior plaster-of-Paris splint.

There was a slight reaction for twenty-four hours after the operation, but within three days the pulse rate and temperature had fallen to normal. The wound healed *per primam*. About the tenth day and daily after that the patella was moved laterally a few times. The patient was permitted to sit up in a chair, with the limb extended, and at the end of four weeks he was wearing a posterior splint during the day only, and allowing the knee full motion while in bed. A week later all support was removed and increasing motion encouraged. Motion and strength had gradually returned, but being a heavy man, he was advised to make haste slowly. He was now able to climb stairs without assistance. His left limb was a little stronger than the right.

EPIPHYSEAL FRACTURE AT LOWER END OF RADIUS; OPERATIVE REDUCTION.

Dr. Forbes Hawkes presented a boy of nine years, who on April 7, 1909, fell in the street, striking on his right hand, sustaining a silver-fork deformity of the wrist, with loss of function, and pain. The X-ray plates showed a separation of the epiphysis of the lower end of the radius. Attempts at reduction, at first without anæsthesia and later with a general anæsthetic, were unsuccessful.

On April 13, 1909, an incision was made on the dorsum of the wrist to the thumb side of the tendon of the extensor communis digitorum, which goes to the index-finger. Part of the posterior annular ligament was divided, access thus being obtained to the fractured area. It was seen that a piece of the radio-ulnar ligament and part of the lower portion of the interosseous ligament prevented reduction. By keeping these structures out of the way by means of retractors, and using a periosteal elevator as a "crow-bar," the fragment was brought into its proper position. To keep this fragment in position, it was found necessary to flex the wrist, and it was fixed in that position. The divided portion of the annular ligament was sutured with chromicized catgut and the wound closed. The hand was put up well flexed in plaster-of-Paris. Primary union resulted. The bandage was removed at the end of three weeks, when motion was encouraged. A perfect functional result followed.

At the present time, about two and a half years since the injury, there was no difference whatever in the growth of the bone. The radius presented no thickening at the epiphyseal site.

ULCER OF THE STOMACH AND OF THE DUODENUM.

Dr. George Woolsey presented a man, 36 years old, married, a native of Scotland, and a gardener by occupation. He was admitted to the Presbyterian Hospital on July 6, 1911, at which time he was suffering from an ulcer of the stomach, situated in the lesser curvature near the pylorus. This was excised, an uneventful convalescence following.

He was readmitted Oct. 23, 1911, with the following history: For nine weeks after discharge from hospital he was in good health and gained 8 pounds. Three weeks ago, after an attack of diarrhœa with colic, which lasted 10 days, he began to have epigastric pain most marked above and to the left of umbilicus, coming on one and a half to two hours after eating, and relieved by taking food. There was tenderness on pressure over the site of the pain. No vomiting, but a great deal of acid eructations an hour or two after eating. Had noticed tarry stools at intervals. No mass felt.

Operation, Nov. 3, 1911, Dr. Woolsey: Posterior no-loop gastrojejunostomy. Gas and ether anæsthesia. Only slight adhesions were found between area of gastric ulcer excised and under surface of liver. Slight induration of stomach wall at this point. One-half to three-fourths inch distal to pylorus is an indurated area on postero-superior aspect of duodenum.

Diagnosis, ulcer of duodenum. Patient made an uninterrupted convalescence and was put on a Lenhartz diet. He was subsequently discharged from the hospital feeling perfectly well.

NEPHROLITHIASIS; PYELITIS; CALCULUS OF THE BLADDER.

Dr. George Woolsey presented a man, 37 years old, who was admitted to the Presbyterian Hospital on May 29, 1911, with the history that about three years before he first saw blood in his urine. Cystoscopic examination showed the bladder to be in fair condition, showing no evidence of gonorrhœal or tuberculous cystitis. A small sore was seen in the region of the neck of the bladder. The prostate was not enlarged. The bladder was washed frequently, but in spite of this the urine occasionally showed the presence of blood.

About a year and a half ago the patient had an acute illness, with bloody urine, fever, and gastro-intestinal disturbance. His temperature rose to 106.5° and his urine was thick and yellow. During this attack he passed a cylindrical plug, white in color and hard in consistency. After this his temperature dropped immediately, but he has had similar milder attacks since. A week before admission physician told him that pus was present on catheterization of the ureters.

He had to be catheterized daily, and was able to void, with pain, only small quantities of urine. He had a slight urethral discharge, and complained of pain of moderate intensity in the right side. He ate fairly well, and his general appearance improved. On June 25, his temperature, which had been normal, rose to 103.6° within twenty-four hours; he complained of pain in the right flank and looked acutely ill. A few days later rigidity was noted in the epigastrium and slight rigidity in the right flank. After running a septic temperature for five days his temperature dropped to normal, local signs disappeared, and the patient was able to be up and about, and was apparently gaining in strength. About July 10 he began to complain of a sudden pain in the neck of the bladder on voiding. At the same instant the flow stopped, except for a little dribbling.

On July 15 an X-ray was taken, which showed a strawberry-sized shadow in the right kidney, which Dr. Caldwell regarded as a calculus. Two days later this diagnosis was verified by Dr. Woolsey, who operated and removed a stone about the size of an almond from the pelvis of the right kidney through a posterior incision of the pelvis. It was hard and smooth. During the operation, it was noted that there were many fibrous adhesions over the pelvis. The patient made an uneventful recovery, and ten days later the urine was normal, with the exception of a considerable number of pus-cells, which had been present prior to the operation. The patient was voiding from 46 to 60 ounces of urine daily, without any obstructive symptoms, although he still complained of a dragging pain in the right flank. The symptoms indicating the presence of a vesical calculus reappeared when he was up out of bed. As there was no shadow in the bladder region in the X-ray he was again cystoscoped by Dr. Stevens, and a small stone was found. An unsuccessful attempt was made to remove this by the Bigelow evacuator, and two days later Dr. Hartwell removed the stone by perineal cystotomy. The further recovery of the patient was uneventful, and he left the hospital on August 17, 1911.

BENIGN STENOSIS OF THE PYLORUS; GASTROPTOSIS.

Dr. George Woolsey presented a woman, 65 years old, who was transferred from the medical side of the Presbyterian Hospital on September 25, 1911. The history she gave was that for the past 20 years she had suffered from gastric distress and distention, with eructations of gas and occasional attacks of vomiting. She had also suffered from chronic constipation, with pain in the epigastric, umbilical, or right lumbar regions, often radiating through to the back or to either shoulder. Since December 26, 1910, these attacks had become more severe, and the vomiting had become more frequent. Her symptoms usually began within an hour after eating, and the pain and distress became so severe that the patient was confined to her bed for weeks at a time. The stools were frequently tarry; the vomitus was coffee-ground at times, and on several occasions had contained particles of fruit and green vegetables ingested several days before. The patient had lost about 30 pounds in weight during the preceding eight months.

An examination after insufflation of the stomach showed that the lesser curvature was one inch above the umbilicus, and the greater curvature three inches below. There was visible peristalsis, which was evidently due to pyloric obstruction. A gastric analysis showed a total acidity of 60 c.c., with 32 c.c. of free hydrochloric acid, and an absence of lactic acid. Blood was present.

On September 25, 1911, Dr. Woolsey did a no-loop gastrojejunostomy and gastropexy. The pyloric ring was found to be much thickened and contracted, especially anteriorly, where there was the puckered scar of a healed ulcer. There was marked gastroptosis, but no evidence of malignant disease. To prevent traction on the jejunal loop, the stomach was held up to about the level of the umbilicus by two silkworm gut sutures which were passed transversely, each suture taking three bites of the stomach wall (Rovsing's method). These sutures were removed after 10 to 14 days.

The patient made an uneventful recovery from the operation, and was discharged, cured, on August 10, 1911. Since then she has gained much in flesh and strength, she has no gastric trouble, and looks and feels like another woman. The interesting feature was the gastropexy, which was only done to avoid traction on the suture line and the danger of tearing it out. The gastropexy caused no pain or trouble while the patient was in bed or after she was up and about.

FIBROMA OF THE POPLITEAL SPACE.

Dr. George Woolsey presented a woman, 24 years old, who was admitted to the Presbyterian Hospital on July 13, 1911, with the history that about two years before she first noticed gradually increasing stiffness of the posterior aspect of the right knee on flexion, and about a year later she felt a mass in that region. This gradually grew larger, and nine months ago an operation was done at which only fatty tissue was said to have been removed, and which gave her no relief. There was gradually increasing pain and swelling, and the incision of the operation healed very slowly.

Examination showed a large, hard, deeply-seated, immovable mass in the right popliteal space. It was not very tender; no redness nor heat. Motion of the affected limb was limited, but not very painful, the pain being limited to the popliteal space and down the leg. An X-ray was taken, which showed no connection between the tumor and the bone.

Operation, July 13, 1911, by Dr. Woolsey: A long longitudinal incision was made through the deep fascia, disclosing the external popliteal nerve, which lay quite superficial and was displaced slightly outward. The internal popliteal nerve was much displaced posteriorly; it was separated from the vein by the tumor and lay in a deep groove in the upper end of the tumor. The latter was quite adherent to the vessels, especially to the popliteal vein, and to avoid injury to the vein, the femur was divided into three segments before its removal. It was also very adherent to the inner head of the gastrocnemius, so that a thin layer of the inner head of that muscle had to be removed with it. The tumor was about the size of a large grape-fruit. The space left after its removal was drained by two cigarette drains. With the exception of these openings the wound healed *per primam*, and the patient made an excellent recovery. A few days after the operation there was some swelling of the leg, together with a feeling of numbness and tenderness, especially along the course and distribution of the external popliteal nerve. These symptoms persisted for some time, and walking was at first painful because it necessitated the stretching of the gastrocnemius as the heel was drawn up, so that she walked on the toes. But gradually, under passive motion and massage, the heel was brought down, and she had no further trouble. Pathologically, the growth proved to be a fibroma.

SUBPHRENIC PERINEPHRITIC ABSCESS.

Dr. Woolsey presented a boy, four years old, who was admitted to the Presbyterian Hospital on September 22, 1911, with the history that for a month prior to that time he had not been feeling well.

Examination showed a slight fulness in the right flank, and palpation gave a sense of resistance and the presence of a firm mass, about the size of an orange, which extended down about to McBurney's point. It was moderately tender, not movable nor moving with respiration, and did not fluctuate. The case was regarded as one of abscess of a high appendix, and on September 22 Dr. McWilliams and the house surgeon exposed the appendix, which was found slightly congested but practically normal in gross appearance. There was a firm, non-fluctuating mass felt as if springing from the anterior border of the liver in the anterior axillary line, and extending thence outward, downward, and to the right, where it was firmly attached to the lateral wall of the abdomen. It was apparently extraperitoneal, about four inches in diameter, and projected about an inch or more into the abdominal cavity. Its surface was smooth, with some irregularities over the lower part. The mass was regarded as a possible gumma of the liver.

At the time of the patient's admission, a blood count was made, which showed 24,800 white blood-cells, with 86 per cent. of polynuclears. Two days after the operation, the white blood-cells numbered 26,100 and the polynuclears 86 per cent. His temperature, which was 103.4° on the day following the operation, gradually fell to normal, but the abdominal distention, pain, and local tenderness in the right lumbar region were unrelieved. Wassermann reaction negative.

On September 27, Dr. Woolsey made a two-inch incision just below and parallel to the ribs, over the mass. A needle was inserted, which withdrew pus. The opening was then enlarged, and two ounces of pus evacuated. The mass proved to be a perirenal subphrenic abscess extending up to the postero-inferior border of the liver. This was drained, and the further recovery of the patient was uneventful. He left the hospital, cured, on October 27, 1911. Cultures from the pus and from the throat gave a pure culture of *Staphylococcus aureus*. The urine was practically normal.

NEPHROLITHIASIS OF THE KIDNEYS; CALCULUS IN LEFT URETER; SINUS OF LEFT KIDNEY.

Dr. Woolsey presented a woman, 49 years old, who was admitted to the Presbyterian Hospital on July 17, 1911. She gave a history of having had mild pains in the kidney regions for 20 years prior to March, 1906, when she was operated on at Bellevue Hospital, where three stones, including a large, pipe-stem one, were removed from the right kidney. The kidney consisted of a thick shell containing several large pus pockets. Her pain persisted, and an X-ray showed stones in both kidneys. Right nephrectomy was planned, but a ureteral catheterization showed that the right kidney was apparently the better of the two. In November, 1906, the patient was again operated on, this time at the Presbyterian Hospital, where one stone, the size of an olive pit, and several smaller ones were removed from the right kidney. At this time, two small pockets of pus were opened, and the kidney was drained. On the sixth of the following month the left kidney was opened, and three or four calculi removed. This kidney was found to be much enlarged, adherent, and filled with pockets of thick, greenish-yellow, foul-smelling pus. After this operation, a sinus persisted for nearly a year. The wound on the right side had healed readily, and the patient gradually gained in strength.

Following the above operations, the patient had occasional slight attacks of pain in the right lumbar region, and eight days before her recent admission to the hospital she was seized with a sharp, severe pain over the old wound on the left side, followed by the appearance of a hard but not very tender mass. On the day of her admission, this swelling broke, and with the spontaneous evacuation of a large quantity of greenish pus, her pain ceased. An X-ray showed stones in both kidneys, more pronounced on the left side, and there was also a stone in the left ureter at the brim of the pelvis. In the middle of the left lumbar scar there was a small sinus discharging yellow pus, without urinous odor. On bimanual examination, a mass twice the size of the kidney was felt in the left upper quadrant. It could be pushed forward from behind, was firm and smooth, and not very tender. The acute onset of the painful swelling was probably due to the blocking of the left ureter by the calculus.

On July 28, 1911, Dr. Woolsey opened the old scar, evacuating three pockets of pus and partly freeing the kidney from adhesions, but these were so dense that he was unable to deliver it into the wound. The kidney was thereupon incised, and with some difficulty several phosphatic stones were removed, one the size of a robin's egg and two of bean size. The abscesses seemed to be outside of the kidney, which was very much altered and reduced to a thick shell. The wound was closed, with drainage.

The patient made a good recovery. The amount of pus in the urine gradually decreased, and under the use of urotropin, the reaction of the urine first became neutral and then acid. The wound was closing well and draining considerable urine, and the patient was able to leave for home on August 21, 1911. It is planned to remove the ureteral calculus, if necessary, at a future date.

The interesting feature of the case is that after the first three operations, all done by Dr. Woolsey, she became so well and strong that she has been able to do her housework for the past four years, though each kidney was a mere shell of a suppurating sac. Each kidney would have been removed, if the other had been healthy. The case serves to show how much may be done by conservative surgery in such cases, even when both kidneys are infected.

PERFORATING DUODENAL ULCER, COMPLICATED BY BILATERAL SUBDIAPHRAGMATIC ABSCESS.

Dr. Ellsworth Eliot, Jr., presented a man, 44 years old, who was admitted to the Presbyterian Hospital on March 6, 1911. For the past year he had complained of indigestion, with vague sensations of pain and oppression in the epigastrium, sometimes radiating to both shoulder-blades; these pains occurred from two to four hours after meals and were relieved by taking food. He also suffered from gaseous eructations, and occasionally vomited a greenish fluid.

On the day prior to his admission he had a sudden attack of pain, severe and colicky, in the epigastric region; this radiated to the left and was persistent. There was no history of vomiting; the bowels had not moved for 48 hours, and two enemas had been given without result. Upon admission, the abdomen was found moderately distended; it was very rigid, especially in the right upper quadrant, with generalized tenderness and tympany, except in the right flank, where dulness, as far forward as the edge of the rectus, could be elicited. A rectal examination was negative. The patient's temperature was 99.5°; pulse, 116; respirations, 24. A blood count, made on March 7, showed 7000 white blood-cells, with 88 per cent. of polymorphonuclears. The urine contained a heavy trace of albumin and many casts.

Operation: 36 hours after perforation under ether anæsthesia, the peritoneal cavity was opened through an incision parallel to the upper outer margin of the right rectus muscle, enlarged by a second incision extending at right angles to its upper extremity toward the median line. There was an immediate gush of a large quantity of turbid, dark-colored fluid, containing gastric and duodenal contents completely filling both subdiaphragmatic spaces, the space between the left lobe of the liver and the abdominal wall and the right lower half of the peritoneal cavity, together with the pelvis. The fluid was thicker, more gummous, and more offensive about the pyloroduodenal junction than at the more distant parts. A perforation in an indurated ulcer the size of a 25-cent piece was found in the anterior upper wall of the duodenum just beyond the pylorus. It was closed with a purse-string suture, reinforced by two Lemberts.

The peritoneal cavity was cleansed by general irrigation. Cigarette drains were introduced into either subdiaphragmatic space and through the suprapubic opening below into the pelvis. The abdominal incision was then rapidly closed by suture.

The patient made an excellent recovery from the anæsthesia. For a week the drainage was satisfactory. The discharge from the pubic opening was serous and the opening rapidly closed after removal of the drain on the fifth day. The discharge from the upper opening was purulent, thick, and offensive, and in this situation the sutures did not hold, the wound healing slowly by granulation. At the end of 10 days the temperature and blood count indicated pus retention, and as the patient's condition did not warrant a posterior transpleural counter-opening, the device of attaching siphon drainage to a catheter introduced into the left and right subdiaphragmatic space was adopted with excellent results. The sinuses ultimately closed. The one between the left lobe of the line and abdominal wall, which was the least deep, was the last to heal. Three months after the operation a stomach analysis showed no hyperacidity. There has as yet been no recurrence of any ulcer symptom.

RESECTION OF INTESTINE IN STRANGULATED FEMORAL HERNIA.

Dr. Ellsworth Eliot, Jr., presented a woman, 61 years old, who was admitted to the Presbyterian Hospital on January 15, 1911. Her family history was negative, and her past history had no bearing on her present illness, which had its onset six days before, beginning with cramps in the abdomen, with constipation, and followed by vomiting. The vomitus consisted of large quantities of bad-tasting, brownish fluid, and it occurred about once or twice daily. The patient complained of extreme thirst. Upon admission, her temperature was 98°; pulse, 112; respirations, 24. There had been no passage of either gas or fæces for six days.

Upon examination, the abdomen was found to be moderately distended, especially over its lower half. There was no visible peristalsis. In the right femoral region there was a mass about the size of a hen's egg. This was irreducible, not painful, and dull on percussion. The overlying skin was normal.

Operation: The sac of a femoral hernia, exposed through a vertical incision, was found to contain blood-stained fluid with a loop of necrotic small intestine. A second incision was then made, just above Poupart's ligament, as in the McBurney muscle-splitting operation for appendicectomy, and the loop of small intestine passing through the hernial opening quickly identified. The constriction was then relieved by division of Gimbernat's ligament from below and the liberated loop rapidly withdrawn through the intermuscular incision. A resection with end-to-end anastomosis by suture was then carried out in the usual way. In case of leakage the intestine was sutured with one catgut suture to the edge of the parietal peritoneum and the incision closed with a small rubber tissue gutter passing to a point just within the cavity.

The patient made an excellent recovery with the exception of an intestinal fistula, which developed on the fifth day and after the fifteenth day closed spontaneously. The hernial incision healed primarily.

LIGATION OF COMMON CAROTID FOR PULSATING EXOPHTHALMOS.

Dr. Eliot presented a man, 51 years old, who was admitted to the Presbyterian Hospital on October 15, 1909. His family history was negative. The patient had been addicted to the moderate use of beer and whiskey. Over 30 years ago he had an attack of gonorrhœa. Ten years ago a piece of steel entered the right cornea, resulting in ulceration and partial loss of sight of the right eye.

Present illness: Five weeks prior to his admission to the hospital, the patient was assaulted by three men, receiving a blow over the left zygoma with some heavy instrument. After a brief period of unconsciousness, with bleeding from the mouth and nose, which was fractured, he was able to walk home. The left eye was swollen and nearly shut; this swelling gradually became less, and 17 days after the injury he had some use of the eye. Two weeks ago he first noticed that the left eyeball was protruding, and during the past week the under lid had become everted. With every beat of the heart there was a throbbing pain in the eye, and a murmur or buzzing sound could be heard distinctly in the left ear. The patient complained of pains of great intensity shooting from the left to the right side of the head. He was dizzy at times; no vomiting.

Examination showed marked exophthalmos of the left eye, which protruded to the plane of the orbital ridge and bridge of the nose. The eyelids were swollen, and between them was a red area of conjunctival tissue, one inch long and a quarter of an inch wide. On separating the lids, the conjunctiva about the iris was found to be swollen and crowded over it somewhat. The eye reacted slightly to light and accommodation. Its pulsations could be distinctly seen and felt, and a continuous blowing murmur could be heard over the entire skull and vessels of the left side of the neck; this sound was exaggerated with every heart beat, and was loudest over the left eye. An examination of the eye-ground showed marked swelling of the optic papilla, with œdema of the retina. The veins were enlarged and tortuous; the arteries small.

Operation: Ligation of the left common carotid, just above the omohyoid muscle.

There was no sign whatever of interference with the cerebral circulation. The intracranial murmur ceased and the exophthalmos rapidly disappeared, so that at the end of ten days very little remained. At present, three years after operation, the eyesight has gradually improved and patient can use the eye in walking and in distinguishing objects at a distance. Continued use, in reading, results in headache. There is no suggestion of an interorbital swelling.

On November 2, 1909, when the patient was discharged from the hospital, the exophthalmos had largely receded, and the left eye was but little more prominent than the right. The swelling of the lids had disappeared, so that they were able to close over the eye, but there was still some redness and congestion. The patient was able to count fingers with the left eye at a distance of ten feet, but the sight of the eye was still much impaired. The sight was gradually improving and the pain was much less severe. The murmur heard over the cranium had disappeared. The patient still complained of slight pain in the occipital region.

Dr. Gibson showed photographs of a case where he had ligated the common carotid in 1904. In that case there had been some intracranial operation, during the course of which some trauma was inflicted, and further operative measures had to be abandoned on account of very severe hemorrhage. When Dr. Gibson first saw the patient, the eyes were bulging, and the sight of one eye was lost. He tied the common carotid, and in the course of time the patient recovered entirely, so far as the restoration of the usual appearance of the eye was concerned.

MEGACOLON.

Dr. Joseph A. Blake presented a woman, aged 24 years, who was admitted to the Presbyterian Hospital January 18, 1911, and discharged March 28, 1911.

Her history before admission to the hospital was, briefly, that of chronic constipation for three years. Shortly after this commenced she had noticed a mass about the size of an egg in the left lower quadrant of the abdomen. This mass has gradually increased to its present size. Four years before admission the patient had been laid up for nine weeks with what was said to be "kidney trouble," at which time she had general anasarca.

Physical examination on admission revealed a marked bulging of the left flank. Upon palpation a mass the size of a child's head was felt in the left lower abdomen, freely movable from side to side, but not so freely upward. The mass was not tender, and on pushing it up the uterus seemed to be elevated. On this account a presumptive diagnosis of ovarian tumor was made.

The abdomen was opened by a median suprapubic incision, and a marked enlargement of the large intestine was found confined to the descending sigmoid colon and the upper part of the rectum. The wall of the colon was much hypertrophied. The mesocolon was so long that the sigmoid could be lifted for at least fifteen inches outside the abdomen.

Considering the fact that the increase in the diameter of the colon extended well down into the rectum, it was deemed inadvisable to do an end-to-end anastomosis; so the mesocolon, having been divided and ligatured, as much of the colon was drawn from the abdomen as would at the same time permit of easy approximation of the descending colon with the rectum. These were then sutured together at their mesenteric attachments. The protruding limit of gut was then left intact in the lower angle of the wound until the remainder of the wound had been closed. Each limb was then clamped separately and divided beyond the clamps with a cautery. A tube was then introduced proximal to the clamp in the oral limb and surrounded by a purse-string suture. Thus a complete artificial anus was created, which was finally closed by cutting out the spur with an enterotribe and then closing the remaining fistula by a later operation. An examination of the specimen removed was made by Dr. A. D. Whipple, who reports as follows:

Macroscopical.—The specimen consists of part of the descending and sigmoid colon. In length it is 120 cm. (48 inches). The greatest circumference is 42.5 cm. (17 inches). In the lumen of the descending colon is an enterolith weighing 980 gm. which measures 14.5 x 10.5 x 11 cm. This fecal mass contains melon and grape seeds, beans and much amorphous detritus. The centre of the mass is almost dry.

The entire specimen shows marked thickening of the intestinal wall, most pronounced in the sigmoid portion below the enterolith. The hypertrophy of the muscular coats, particularly the inner circular, is very noticeable. The muscular coats in the sigmoid measure 3 mm. compared to the normal diameter of 1–1.5 mm. The mucosa is also thickened, measuring 1 mm. in places. In the muscular border there is a very noticeable dilatation of the vessels. The appendices epiploicæ are very large. Lymph-nodes in the mesocolon are numerous and larger than normal.

Microscopical.—The number of villi in a given area—1 sq. mm.—in different sections from the mucosa of the transverse colon appears to be fairly constant, and this number compared with the number of villi in equal areas in sections taken from two specimens of colon removed for carcinoma of the sigmoid, as well as from a normal colon, is approximately the same. An Ehrlich eye-piece with the stage micrometer was used in counting the villi.

This would indicate an increase in the number of villi commensurate with the increase in size of the entire colon.

There is some round-cell infiltration of the mucosa with enlargement of the small vessels between the villi.

As in macroscopic examination, the two muscular coats and serosa show marked hypertrophy. The lymph-nodes show simple hyperplasia.

The count of the villi is interesting, showing that the villi were increased in number so that the same number of villi existed as in a normal intestine. This places it in the category of congenital malformation of the intestine, and not a secondary enlargement.

Stated Meeting, held December 13, 1911.

The President, Dr. Charles L. Gibson, in the Chair

COIN LODGED IN THE ŒSOPHAGUS FOR SIX MONTHS.

Dr. Charles L. Gibson showed a child, 22 months old, who six months previously had suddenly developed difficulty in swallowing, the cause of the trouble not being known nor suspected. The child was admitted to the pediatric service of Dr. C. F. Collins at St. Luke's Hospital, and an X-ray was taken which showed a nickel coin lodged at the level of the fourth dorsal vertebra. The child was able to swallow fluids with moderate discomfort and nutrition was fair.

All attempts to grasp the coin by means of various modern apparatus failed, but with the coin catcher it was extracted with great ease and without any trauma. The child was now able to eat solid food without discomfort.

FRACTURE OF THE ZYGOMA.

Dr. Gibson presented a man, 22 years of age, who three weeks before operation fell against a sharp object, striking against the upper part of the cheek. The accident was followed by immediate limitation of the movements of the lower jaw. On admission to the hospital there was pain and infiltration of the overlying tissue over the distal portion of the zygoma, and within ten days a depression of the soft parts became visible. By open incision, a V-shaped fracture of the zygoma, half an inch from the malar, was revealed, and the fractured bone was elevated into its correct position. Movements of the jaw at once became normal.

It was possible, Dr. Gibson said, that the limitation of motion of the jaw in this case might have improved in the course of time with conservative measures. Most of the recorded cases showed such a result.

MESENTERIC THROMBOSIS, WITH RESECTION OF OVER FIVE AND ONE-HALF FEET OF GUT

Dr. N. W. Green presented a woman, 43 years old, who was admitted to St. Luke's Hospital, on the service of Dr. Robert Abbe and Dr. Walton Martin, June 19, 1911. Her family history was unimportant, and her previous history had no special bearing on her present illness. This began one week before admission, when she ate some food which gave her a diarrhœa and cramps for two days, and on one occasion, three days before admission, she passed a black stool.

At 3 A.M. on the day of her admission she was awakened with severe abdominal pain one inch to the left of the umbilicus. This pain gradually increased in severity. It remained localized in the midabdomen, with tenderness in that region. She was given some medication, which was followed by nausea and vomiting.

As the patient's symptoms indicated the presence of an intestinal obstruction, an operation was decided on. This was done by Dr. Green sixteen hours after the onset of the pain. Upon opening the peritoneum, a litre of red fluid escaped. A coil of intestine, reddish-black in appearance, was found extending transversely and slightly upward from the left iliac fossa to above the ileocæcal region. The discoloration of this coil of gut was not uniform, being lighter in some places than in others. The mesentery was red and œdematous along its intestinal attachment. Over five and a half feet of the gut was resected, and after testing the remaining portions by cutting off additional pieces four or five inches long until free bleeding was obtained, it was anastomosed with a Murphy button, reinforced with a Lembert stitch. The mucous membrane of the excised gut was quite black. The abdominal cavity was washed out with saline solution through a Blake irrigator, and the wound closed, with drainage, to the site of the anastomosis. The diagnosis was made at the operation and was materially aided by the similarity of the picture presented on the table to that of Dr. Schley's case of last year. The pathological examination showed thrombosis of the veins in the mesentery.

The button was discharged some weeks after the operation. A sinus persisted for several weeks, but finally healed, and the patient has resumed her work.

An interesting point is that although during her convalescence she suffered from an intercurrent apical bronchitis, she has gained 35 pounds since her discharge from the hospital.

DR. WINFIELD S. SCHLEY said that some months ago, in the medical service of Dr. Theodore C. Janeway at St. Luke's Hospital, he saw a case similar to the one shown by Dr. Green, and had operated. The patient was a man who evidently had some serious intra-abdominal condition, and while no positive diagnosis was made, a laparotomy was clearly indicated and he was transferred to the First Surgical Division. Upon opening the abdomen a mesenteric thrombosis was discovered. On section of the mesentery the arteries bled but the veins were thrombosed. The abdomen was filled with bloody serum from the diapedesis of the red blood-cells. The black-red gut was excised together with several inches of healthy intestine, beyond lines of demarcation, some 22½ inches altogether being removed. An immediate end-to-end anastomosis was done. This patient made a perfect recovery. These cases of mesenteric thrombosis, Dr. Schley said, were perhaps somewhat more common than we had been led to believe. They could be divided into two groups, the acute cases and the chronic cases. The former were almost invariably fatal and were of more frequent occurrence than the chronic cases. In 214 cases collected by Jackson, Porter, and Quinby from the records of the Massachusetts General Hospital and other sources, 47 per cent. were operated on with a mortality of 92 per cent. The mortality in this acute variety is undoubtedly increased by faulty diagnosis, delayed operation, and imperfect technic. One fatal case showed but an inch of involved gut and would almost surely have recovered with operation. The chronic cases might last for months or years and the true condition only be recognized at autopsy, or the latter might disclose a condition that had never given rise to symptoms or been suspected during life. The occlusion of a large vessel might occur without lethal termination, provided the process was very slow.

The President, DR. GIBSON, said he was rather inclined to think that this condition of mesenteric thrombosis was more frequent than we had been led to believe. Personally, he had seen four cases, two of them in his own practice. In one of the latter, the diagnosis was verified by operation and in the other by autopsy. In one of these cases, where he had made the diagnosis before opening the abdomen, in addition to the vomiting, distention and pain, there were evidences of intestinal obstruction, but the obstruction was not complete, and this he thought was a distinguishing feature in all of these cases, nor did we get the characteristic blood picture of a spreading peritonitis. In the case he had in mind, there was a practically level blood line; this and the pain in the back were very suggestive.

FIVE CASES OF GRAVES' DISEASE.

DR. JOHN ROGERS showed these cases to illustrate variations in the pathology and treatment of different forms of Graves' disease,

CASE I.—This was a Swiss seamstress, 50 years old, who gave a history of goitre existing for the past 25 years. Five or six years ago, following a strenuous period of night work and insufficient nourishment, the typical signs of Graves' disease, but without exophthalmos, began to appear, and continued with more or less interruption, apparently depending upon rest and ease or fatigue.

She first came under observation in December, 1909, and complained chiefly of dyspnœa on exertion, insomnia, vasomotor irritability, and weakness. Pulse was 110 and blood-pressure 170. There was an irregular, nodular goitre with some stridulous breathing, which indicated pressure on the trachea. These symptoms were all relieved by feeding a preparation of the adrenal proteids and enforcing more or less hygiene, but the blood-pressure could not be reduced lower than 145. The unavoidable pressure of work and worry incident to her occupation, however, produced frequent recurrences of the signs of thyroidism, and in 1910 headache became more or less troublesome.

Therefore, on July 25, 1911, a radical operation was undertaken under nitrous oxide anæsthesia. The chief enlargement of the thyroid and the greatest pressure on the trachea seemed to be on the left side, and this lobe was removed first together with the isthmus. When it was turned out on the neck, the trachea collapsed and the imminent danger of asphyxia was avoided by pulling the trachea open with a tissue forceps attached to its most collapsed portion. It was then found that a substernal nodule on the right side had produced an S-shaped deformity of the trachea, and this part of the goitre was below the clavicle. This was then turned out by the finger introduced next to the trachea, but in lifting this part of the gland up the organ tore across in the middle of the right side. In controlling the hemorrhage, considerable more of the thyroid was sacrificed, and at the close of the operation there was left only a small nodule about an inch and a half in diameter at the upper pole of the right lobe. The trachea was sutured to the deeper muscles and fascia of the neck with catgut to keep it open. The pulse-rate had risen to 140 at the conclusion of the rather bloody operation, but at the end of two or three days all alarming symptoms had subsided, although the anæmia required some weeks to disappear. Patient left the hospital at the end of three weeks, and now is conscious of no abnormality. There is some headache, however, after fatigue, and the pulse-rate is slightly irritable but averages about 80. The blood-pressure averages 170. There seems to be a necessity of a moderate amount of feeding with the thyroid proteids to relieve the so-called fatiguability and the tendency to constipation. The headaches in these cases of manifest thyroid disease are a great puzzle, as some of them are relieved by operation and some are made worse. This first case also shows that a very small amount of thyroid tissue seems to be sufficient in older patients. It certainly is not sufficient in those who are under thirty. In other words, radical operation upon the thyroid is much better borne after middle life than before it, and more thyroid tissue can be sacrificed in age than in youth without serious consequences. It is also noticeable that this patient, at present, does not do well on the adrenal feeding which seemed extremely beneficial before the thyroidectomy.

Case II.—A man of 24 years, who first came under observation in June, 1910, with a very severe condition of typical exophthalmic goitre. There was pronounced exophthalmos and a large, symmetrical goitre. Pulse of 140, with a blood-pressure of 110 and great emaciation. He had been treated in the medical ward for the previous six months with the antithyroid serum, and had recovered partially from an acute toxæmic thyroidism. This followed a period of strenuous night and day work as a telegraph operator. After a couple of months of anti-serum treatment, the blood pressure would rise to 140 or 150 following each injection, and the symptoms were made worse instead of better.

Therefore, on July 13, 1910, under novocaine anæsthesia, the left superior and the right inferior thyroid vessels were ligated; and on July 22, the right superior and the left inferior were similarly treated. This was followed by considerable improvement, and in September the neck had decreased three inches in circumference but the blood-pressure was found to average 160 to 170. He was then placed upon a preparation of the adrenal proteids, as in the previous case, and immediately began to gain in all respects, and the blood-pressure slowly decreased. In July, 1911, a year after the operation, during which period he led a most hygienic mode of life with the constant administration of the adrenal proteids, the pulse-rate averaged 70 to 80, the blood-pressure was 150, the exophthalmos had disappeared, and the only abnormalities were moderate soft goitre and rather marked asthenia. This asthenia and the size of the goitre increased immediately if the feeding with the adrenal proteids was omitted for even one day. There has been a gain of 40 pounds in weight since the operation. At present the only abnormality is the moderate-sized soft goitre.

Case III.—A married woman of 23 years, who first came under observation in December, 1910. She had suffered from typical exophthalmic goitre for five or six months. This followed a rather strenuous period during which she bore a child and did the housework for a large family of relatives. There was a large, firm, symmetrical goitre with exophthalmos, and pulse-rate of 150 and blood-pressure of 120.

On December 23, 1910, under novocaine anæsthesia, the two superior and right inferior thyroid vessels were ligated. There was a severe reaction to this operation, which was quieted by a single dose of the antithyroid serum. On January 7, 1911, the left inferior thyroid artery was ligated under local anæsthesia. This was followed by a slight but steady improvement, and in the spring she went to Europe and was much benefited, apparently, by the change and rest. At present, the only abnormality is a somewhat irritable pulse-rate and a small soft goitre. The important point in this case is that she is now three months pregnant and shows no pathological manifestations except that she is somewhat fatiguable. This curious asthenia, so characteristic in these thyroid cases, seems to be entirely relieved by feeding with a fiftieth of a grain of the combined thyroid proteids four times a day. This third case, by the way, has gained nearly fifty pounds since the operation.

Case IV is more recent and is a young girl of 16 years who has suffered from typical exophthalmic goitre of a severe grade for about one year. It seemed to develop after she had grown rapidly and had taken a position as a cash girl in a department store where she had very fatiguing work. She first came under observation in August, 1911, with a pronounced exophthalmos, and a large, firm goitre, which showed extreme vascularity. The pulse-rate was 150, the blood-pressure 120, and the weight was ninety pounds although she was five feet ten inches tall. There was rather noticeable brownish pigmentation of the whole body. This represents one of the severest forms of the disease.

On August 7, 1911, the left superior and right inferior thyroid vessels were tied, under local anæsthesia, and on August 14 the right superior and left inferior vessels were similarly treated. A month later on attempting to get out of bed there was a typical attack of tetany, which subsided when a fiftieth of a grain of thyroid proteids was administered every four hours. This thyroid feeding was followed by a very remarkable gain in weight of about four pounds each week. At present, she is still somewhat emaciated, but weighs 130, which is forty pounds more than when she first came under observation. She still shows some signs of thyroidism in the slight right exophthalmos and the average pulse-rate of 90 to 100.

Case V is a farmer of 45 years, who has been sick about eight months with typical severe Graves' disease. This seemed to follow a period of unusual strain attendant upon care for a sick wife, a large milk farm, and several mortgages. When he first came under observation in November of this year, there was moderate exophthalmos, a pulse-rate of 130 to 150, a moderate-sized firm goitre, extreme emaciation, and asthenia.

On November 21, 1911, the right superior and left inferior thyroid vessels were tied, under local anæsthesia, and on December 1 the left superior thyroid vessels were similarly treated. There was an immediate and marked improvement in the pulse-rate, nervousness, and insomnia, but a troublesome dry cough developed, which could only be relieved by feeding a fiftieth of a grain of the thyroid proteids every four hours. There has been a gain of two or three pounds in weight each week, and the pulse-rate is now between 70 and 80 regularly, and hence it seems that it will be unnecessary to tie the remaining inferior thyroid vessel. If, however, any signs of relapse develop, the right inferior thyroid artery will be immediately tied.

The adrenal proteids referred to above are prepared in the same way as are the active ingredients from the thyroid gland. That is, the respective organs, generally the beef adrenals or the sheep thyroids, are hashed and suspended in salt solution for twenty-four hours, and the coarser particles are strained out through sterile filters, and the filtrate at a temperature of 40° to 50° C. treated with dilute acetic acid. The precipitate thus obtained represents the thyroid or adrenal proteids. In the case of the thyroid the proteids are standardized at the Loomis Laboratory according to their iodine content. The adrenal proteids are not standardized, but being treated in the same way each time are presumably closely alike in each preparation. They do not contain epinephrin, but a vasodilator instead of a vasoconstrictor substance.

The most obvious facts in these cases are their apparent origin in some fatigue process, and hence the presumable fatigue of the thyroid. This induces in the gland some alteration in its biochemical relationship with iodine which causes variations in both the quantity and quality of its secretion. The first requisite is to obtain rest for the thyroid, and this seems most safely and properly brought about by cutting off its blood and nerve supply. No more than two of the vessels, however, can be tied at one sitting without considerable risk. The upper and lower vessels on opposite sides have been selected in these and other cases for operation, to avoid risk of paralyzing the phrenic, pneumogastric, and sympathetic nerves by the local anæsthesia. If both lower vessels were ligated at the same time, there is considerable risk of paralyzing the phrenics by the novocaine.

The inferior artery is reached by a two-inch incision along the outer border of the lower end of the sternomastoid muscle. The outer edge of the jugular vein is exposed, avoiding or cutting if necessary the external jugular, then the fascia at the outer edge of the external jugular is cut through, and the great vessels turned forward. By a little blunt dissection the inferior thyroid artery is found in the deep parts of the neck about one finger's breadth above the inner end of the clavicle, and tied where it passes transversely behind the common carotid. The inferior artery, by the way, is ligated with less pain than the superior, which has to be exposed by drawing aside the hyoid muscles. It is important in all these cases to excise the top of the thyroid lobes together with the vessels in order to cut all the blood supply. The superior thyroid vessels generally subdivide into several branches just before entering the gland, and it is quite easy to overlook one of these subdivisions unless half an inch of the top of the thyroid lobes is cut away. This excision of the top of the thyroid lobe gives much comfort to the patient subsequently, as without it there is considerable pain in swallowing for several days.

As evidenced by the necessity for adrenal feeding, and the very apparent benefit in certain cases, noticeably all those which have a blood-pressure of 140 and above, it seems probable that with the presumable fatigue of the thyroid there is a fatigue in the adrenal gland, which is known to be closely associated in its functional activity with the thyroid. The feeding with the adrenal as with the thyroid proteids is for the purpose of relieving the strain upon these organs, and by supplying a defect in the organism the nutrition is improved.

The surgeon's duty to these cases by no means ends with the operative interference, but they must be closely supervised for from six months to two or three years, during which time hygiene in the form of avoidance of fatigue and yet with the provision of sufficient exercise to maintain nutrition must be provided. In addition, thyroid feeding below the point where it activates the thyroid itself can, in the majority of cases, be continued. Those which have a high blood-pressure cannot be benefited by thyroid feeding, but will be greatly helped by feeding with the adrenal proteids.

More extended reference to these preparations and the theories of treatment can be found in the *Journal of the American Medical Association* for September 2, 1911.

These cases, Dr. Rogers said, showed the results which could be obtained with suitable and cautious treatment. Graves' disease, with symmetrical goitre, could not be as safely and permanently relieved by partial thyroidectomy as by ligation of two or more vessels. The cases with asymmetrical goitres generally must have partial thyroidectomy performed, or at least enucleation of the diseased thyroid tissue. It was important to sacrifice as little as possible of the comparatively sound gland.

PARTIAL ENTEROCOLECTOMY FOR RECURRENT CARCINOMA, WITH REPAIR OF VENTRAL HERNIA.

Dr. Walton Martin presented a woman, 51 years old, who was admitted to St. Luke's Hospital, in the service of Dr. Samuel W. Lambert, on September 27, 1911. The history she gave was that in May, 1894, she was operated on by Dr. Paul Outerbridge at the General Memorial Hospital for a carcinoma of the transverse colon. The transverse colon, with the tumor, was resected, the divided gut being joined by a silver Murphy button. The hospital records stated that the tumor was as large as a fist, but there was no report of the microscopic finding. Dr. Outerbridge himself remembered the case, and believed that the growth was a carcinoma.

The patient made a good recovery, regaining her strength and normal weight. In a few years, however, she noticed a protrusion in the laparotomy scar. This gradually increased until it assumed very large proportions. She remained in good health, however, until two or three years ago, when she began to suffer from abdominal distention and gradually increasing constipation. She attributed these symptoms to her ventral hernia, but in May, 1911, she began to lose weight and strength and was obliged to give up her work. She was then admitted to Bellevue Hospital.

where she was told that she had tuberculosis, and tubercle bacilli were said to have been found in her sputum. While in bed, she discovered a movable, hard tumor in her abdomen. She left the hospital somewhat improved last summer, and in the autumn, as she was still weak and ill, she was admitted to the medical service at St. Luke's Hospital.

Examination at that time showed a fairly well-nourished woman. There was slight dulness at the apices of her lungs, and the aortic second sound of the heart was accentuated. The abdomen was lax and pendulous. There was a median scar from the xiphoid to just above the pubes, and in the middle portion of this scar was an opening through which a large mass protruded. This could be readily reduced. A firm, movable, slightly tender mass could be easily palpated in the right half of the abdomen. The patient's temperature was normal. The urine had a specific gravity of 1012 and contained a trace of albumin. Repeated examinations failed to show tubercle bacilli in the sputum, nor was there any cough.

After the woman had been under observation for several weeks, she was transferred to the surgical division for operation. On September 27, 1911, under ether, the old laparotomy scar, with the hernial sac, was excised, and the abdominal cavity opened. The ascending colon had a mesentery, and was freely movable. At the cæcal junction was a hard mass involving adjacent portions of the ileum and cæcum, and there were adhesions between the coils of the lower portion of the ileum. About ten inches of the ileum and four inches of the ascending colon, together with the adjacent portion of the mesentery, were removed. The divided ends of the gut were united by lateral anastomosis, a double layer of sutures being used for the purpose. The hernia was then repaired by lateral overlapping. After the overlapping of the muscles and fascia, the lax and pendulous skin was found to be redundant, and a semi-ellipse of skin was removed from each side of the lower quarter of the incision. The skin was sutured in the median line to this point, and then transversely, leaving an inverted T-shaped scar.

The section of the gut removed consisted of the lower 40 cm. of the ileum and the first 11 cm. of the colon, together with the appendix and the mesentery. In the cæcum and invading the end of the ileum was a hard tumor, 5 x 5 x 4 cm., white and gritty on section. Its inner surface was ulcerated. Microscopically, it proved to be a gelatinous carcinoma.

The patient made an uneventful recovery from the operation. For several weeks afterward, however, she suffered from diarrhœa, having seven or eight movements daily. At present, these had been reduced to two or three.

Dr. Martin said the case seemed to be interesting on account of the possibility that the original growth, removed 17 years ago by Dr. Outerbridge, was a carcinoma, and that a recurrence had taken place in another portion of the intestine; also, on account of the considerable sections of the gut that had been removed, 18 inches being removed at the first and 20 inches at the second operation. The diarrhœa was presumably due to the interference with absorption in the cæcum and colon.

Dr. Lilienthal said that a number of years ago he showed a patient at one of the meetings of the Society where he had removed an adenocarcinoma of the hepatic flexure, followed by an enterocolostomy. For nine years that patient remained perfectly well, and then developed an inoperable carcinoma of the rectum.

It was probable, Dr. Lilienthal thought, that adenomata were of more common occurrence in the large intestine than we supposed, and that they frequently escaped attention until carcinomatous changes supervened, and this had led him to the conclusion that in dealing with an adenoma or tumor of any size involving the large intestine, he would in future make a careful exploration of the entire colon.

RUPTURE OF THE URETER, FOLLOWED BY EXTRAVASATION OF URINE AND SUPPURATIVE NEPHRITIS; NEPHRECTOMY.

Dr. Walton Martin presented a boy, eight years old, who was admitted to St. Luke's Hospital on May 8, 1911, in the service of Dr. Robert Abbe.

The history obtained was that six weeks previously he had been run over by an ice wagon, both wheels passing over the patient, who was lying on his stomach. He suffered from shock, but was not unconscious. Immediately after the accident, he vomited several times, and complained of pain in his back and lower abdomen. He was taken to the Harlem Hospital.

remaining there for several hours, and was then removed to his home. During the next two or three days he continued to vomit from time to time, and complained of pain in the loins. No blood was noticed in his urine, nor was any observation made of the amount of urine passed. Subsequent to this he improved somewhat and was up and about, but he still complained of pain in the lumbar region and had occasional attacks of vomiting. About a week before his admission to the hospital his mother noticed a large swelling in the left side of his abdomen.

Examination on admission showed a rather pale and poorly nourished boy. On the left side of the abdomen, from the free border of the ribs to Poupart's ligament, there was a smooth, slightly tender swelling, elastic and tense, over which a fluid wave could be plainly demonstrated. The examination was otherwise negative. The pulse-rate was 116; respirations, 20. The urine was negative. On the day of his admission, he passed fifteen ounces and on the following day nine ounces.

On May 12, 1911, under ether anæsthesia, the abdomen was opened by Dr. Abbe through a seven-inch incision along the left border of the rectus. A cystic mass, about the size of a football, was found. It was beneath the peritoneum and in the neighborhood of the left kidney. On puncture, a clear, odorless fluid was withdrawn. Two large drainage tubes were introduced into the cystic cavity, and gauze packed about the tubes. The abdominal wound was then closed.

On the following morning there was a urinous odor to the discharge from the wound, and from this time until August 7 the boy continued to drain urine from his abdominal wound. His temperature on the fourth day after the operation was 103° F., and he continued with an irregular fever; occasionally, he had a slight chill, followed by a sharp rise in temperature; he looked septic and lost weight.

On August 7, under ether anæsthesia, the left kidney was removed through a transverse incision. The kidney was slightly larger than normal, measuring 9 x 5 x 4 cm. The pelvis was smooth, pale, and apparently thickened. At the junction of the pelvis with the ureter there was dense scar tissue, and a sinus passed from this point to the incision of the previous operation.

Microscopical examination showed areas of kidney tissue infiltrated with pus, blood, and round cells; the tubules were widely separated by an exudate; some were destroyed; the lumen of others was filled with pus and necrotic material. The boy made an uneventful recovery, and left the hospital at the end of seven weeks with the wound healed and the abdominal sinus closed.

Dr. Martin said there were but few cases of ruptured ureter reported. The late Dr. F. Tilden Brown, on October 12, 1904, presented a patient with a history almost exactly similar at a meeting of this Society.

Blauel in an article in the *Beiträge zur klinischen chirurgie,* in June, 1906, based his observations on twelve cases reported up to that time.

Dr. L. W. Hotchkiss, in connection with Dr. Lyle's case, said that in August, 1908, at Roosevelt Hospital, he had operated upon a negro who was brought in with a penetrating shot wound of the abdomen. Laparotomy was performed and it was found that the bullet had perforated both walls of the stomach and lodged in the back. These wounds were sutured and the abdomen closed. About two weeks later an abscess had developed in the left groin, and upon incision this was found to contain much urine, which made it clear that there was a wound of the left ureter. Operation, September 16, three weeks after injury, revealed the ureter completely divided by bullet and its distal end buried in scar tissue and with considerable loss of substance, so that it was impossible to do an anastomosis. The left kidney was therefore removed, and the patient made a good recovery. Shot wound of the ureter, Dr. Hotchkiss said, was an exceedingly rare occurrence.

EXTENSIVE EPITHELIOMA OF THE CHEEK, WITH SECONDARY INVOLVEMENT OF THE GENIAL GLANDS.

Dr. Henry H. M. Lyle presented a man, 52 years old, who was admitted to St. Luke's Hospital in September, 1910. He had a tumor of the left cheek, of eleven weeks' duration. Ten days previously his physician had incised the tumor, but no pus was found.

On examination, there was a large, indurated swelling occupying the left cheek and involving the angle of the mouth. In the centre of the mass there was a discharging sinus. The buccal surface showed a cauliflower-like growth, which was not attached to the jaw. The submaxillary lymphatics were enlarged and hard. A section of the growth, removed for examination, showed it to be a squamous-celled carcinoma.

Operation: A wide excision of the growth, including the angle of the mouth, was made, and the defect closed by a modification of the Dowd operation, plus a flap taken from the neck. Primary union resulted. Ten days previously a block dissection of the neck and submaxillary and submental regions had been done.

Four months later, when the patient returned for observation, an examination showed that the mucoperiosteum of the jaw had become involved, and there were two distinct hard nodules on the cheek, one just below the centre of the malar bone; the second an inch lower down and posterior to the angle of the mouth. There was no cervical involvement.

At a second operation, virtually the whole cheek below the malar bone was removed, along with the fascia and fat covering the masseter. In this fascia, the buccinator and maxillary groups of the genial glands were found to be involved. The left half of the body of the jaw, with the involved mucous membrane of the floor of the mouth, was removed. Cutaneous flaps were obtained from the neck and the right side of the chin. Considerable difficulty was experienced, owing to the cicatricial tissue left from the previous operation. The buccal lining of these flaps was obtained by splitting the mucous membrane of the tongue and turning it upward, after the method suggested by Sonnenburg.

Three months ago a secondary plastic operation was performed to widen the cavity of the mouth, with good cosmetic and functional results.

Dr. Lyle said the points of interest in the case were: (1) the involvement of the genial glands, failure to recognize and remove these at the time of the primary operation having been the cause of the recurrence: (2) the use of a flap of mucous membrane from the tongue to line the cheek.

TREATMENT OF SIMPLE FRACTURES: SOME END RESULTS.

Dr. James H. Hitzrot read a paper with the above title, for which see page 338.

In connection with his paper, Dr. Hitzrot showed a number of patients and stereopticon illustrations.

Dr. George Woolsey said the worst cases he had observed were in transverse fractures of the long bones, especially the femur, in adults. In the cases of this type of fracture shown by Dr. Hitzrot, the reduction of the fracture was apparently excellent. But most of these were in children. In muscular adults it was by no means as easy, and in these cases, if complete reduction cannot be secured under anæsthesia, early operation, reduction, and plating are strongly indicated. Traction is inadequate in such cases if there is any overlapping. The speaker recalled two such cases in the femur in the last few years, treated by extension with a bad result, non-union, and much shortening. Open operation was required, and under such circumstances is far more difficult than in recent fractures.

Dr. Hitzrot, in closing the discussion, referring to transverse fractures, said he did not think that the direction of the fracture made as much difference as the time at which the attempt was made to reduce it. Those cases that were allowed to go untreated tor three or four days were the ones that gave the most trouble, and if extension did not bring about the desired result within a week, it was impossible to reduce them by other non-operative means. These neglected cases were the ones that demanded early operation.

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